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Exemplars

Mathematics in Context

Pearson Edexcel Level 3 Certificate in Mathematics in Context (7MC0)

Issue 1

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About this booklet

This booklet has been produced to support teachers delivering Pearson's new Level 3 Core Maths qualification, Mathematics in Context. The booklet looks at questions from the Sample Assessment Materials. It shows real student responses to these questions and how examiners have applied the mark schemes to demonstrate how student responses would be marked.

The responses are part of a small sample only and have not gone through the standardisation process. Therefore, all comments and marks are provided for guidance only.

How to use this booklet

Our examiners have selected student responses to a range of questions or parts of questions from the trialling of the Sample Assessment Materials. Following each exemplar question you will find:

- The mark scheme for that question
- Student responses to the question (one, two or three responses for each question)
- Examiner commentary on how the mark scheme has been applied and the marks given, and on common errors for this style of question.

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Paper 1: Comprehension

Section A: House prices

Exemplar question 1

1 Refer to **data source A** in the source booklet.

(a) Use the LTV ratio from 2007 to calculate the value of the mortgage loan in 2007.

(2)

(b) Use the information in the table to give **two reasons** why it is harder for those aged 25–36 to afford a property in 2014 than it would have been for their parents in 1983. You should support your answers with appropriate calculations and conclusions.

(6)

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Mark scheme

Question	Working	Answer	Mark	Notes
1.(a)	0.9 × 129499 [Alternative: 129499 – (0.1 × 129499)]	£116549.10	M1	for method to find 90% of £129499 [for method to find £129499 – 10% of £129499] **or equivalent**
	(£)116549.1(0)	£116549.10	A1	A1 £116549.1(0)
(b) (i)	**Deposit as a proportion of property value**			**Deposit as a proportion of property value**
	$\frac{1021}{17021}$ and $\frac{29400}{147000}$ seen (or equivalent)		M1	attempt ratio or percentage comparison between deposit and property value for **both** 1983 and 2014
	awrt 0.06 and 0.2 seen or awrt 6% and 20% seen		A1	both ratios/percentages correct
	Conclusion that the deposit in 2014 is a higher proportion of the property value than in 1983		C1	using their figures as justification
(ii)	**Borrower income as a proportion of property value**			**Borrower income as a proportion of property value**
	$\frac{8316}{17021}$ and $\frac{5918}{147000}$ seen (or equivalent)		M1	attempt ratio or percentage comparison between income and property value for **both** 1983 and 2014
	awrt 0.5 and accept awrt 0.2 seen or awrt 50% and accept awrt 20% seen		A1	A1 both ratios/percentages correct
	Conclusion that the income in 1983 is a higher proportion of the property value than in 2014 (or vice versa)		C1	C1 using their figures as justification
(iii)	**Deposit as a proportion of borrower income**			**Deposit as a proportion of borrower income**
	$\frac{1021}{8316}$ and $\frac{29400}{35918}$ seen (or equivalent)		M1	attempt ratio or percentage comparison between deposit and borrower income for **both** 1983 and 2014
	(awrt) 0.1 and (awrt) 0.8 seen or (awrt) 10% and (awrt) 80% seen		A1	both ratios/percentages correct
	Conclusion that the deposit in 1983 is a lower proportion of the income than in 2014 (or vice versa)		C1	using their figures as justification
			C1	only for comparison using figures straight from table or statements from article
			B2	B1 for each statement (maximum 2 marks), Examples: older FTB in 2014 than 1983 suggests it is harder property value has increased amount of mortgage has increased bigger deposits in 2014 than 1983 higher house prices in 2014 than 1983 stricter mortgage lending criteria in 2014 NB: these comparisons could be made the 'opposite' way round.

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Responses for part (a)

Student response 1

1 Refer to **data source A** in the source booklet.

(a) Use the LTV ratio from 2007 to calculate the value of the mortgage loan in 2007.

(2)

$\frac{L}{129499} \times 100 = 90$ $\frac{L}{129499} = 0.9$

$L = 0.9 \times 129499 = 116549.1$

$L = £116\ 549(.10)$

Examiner comments

A fully correct solution with all working shown.

The candidate has bracketed the 10p in their solution; the mark scheme does show the correct answer to be £116549.10 but an answer of £116549 would be acceptable as, in a practical consideration, mortgages are likely to be granted in whole numbers of pounds.

2 marks awarded (2/2)

Student response 2

1 Refer to **data source A** in the source booklet.

(a) Use the LTV ratio from 2007 to calculate the value of the mortgage loan in 2007.

(2)

90% = 0.9 $129499 \div 0.9 = £143,887.77$

Examiner comments

In this example, the candidates has realised that it is necessary to work with 90% and given the correct multiplier of 0.9 This has then been used incorrectly so no marks can be awarded.

0 marks awarded (0/2)

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Student response 3

1 Refer to **data source A** in the source booklet.

(a) Use the LTV ratio from 2007 to calculate the value of the mortgage loan in 2007.

129499 ÷ 100 = 1294.99

× 90% = (116549.1)

= 90%

= mortgage loan.

Examiner comments

A correct solution. In this case, an answer of 116549.1 is indicated as being acceptable in the mark scheme. However, candidates are advised to ensure that they use correct money notation when giving answer in pounds i.e. £116549.10 in this instance.

2 marks awarded (2/2)

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Responses for part (b)

Student response 1

(b) Use the information in the table to give **two reasons** why it is harder for those aged 25–36 to afford a property in 2014 than it would have been for their parents in 1983. You should support your answers with appropriate calculations and conclusions.

(6)

The loan to value ratio in 2014 is 14 % lower than in 1983 so first time buyers would have to earn more in order to be able to purchase the house.

While ~~wage~~ incomes have risen by approximately 4·3 times, the property values has risen by ~8·6 times - twice as much as the income, so it will be even harder for FTBs to purchase a house.

The deposit to income ratio has also increased :

1983 → $\frac{1021}{8316} \times 100 = 12.3\%$

2014 → $\frac{29400}{35918} \times 100 = 81.9\%$

This means that it would be harder to place a deposit on a house as the buyer would need to save more money.

Examiner comments

The approach taken by this candidate is different to that shown in the mark scheme. It is, however, a perfectly correct solution and so gains full marks. Our mark schemes generally show the most popular methods seen from candidates but all valid solutions from correct methods will be given full marks.

6 marks awarded (6/6)

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Exemplar question 2

Refer to **data sources A, B and C** in the source booklet for Questions 2 to 5.

2 Determine whether the average house price at the end of November 2013 was greater or less than the average house price at the end of January 2014.

(3)

Mark scheme

Question	Working	Answer	Mark	Notes
2.	$N \times 0.995 \times 1.011 = 175546$			a correct equation linking Nov (N) and Jan figures, for example:
	$N = \frac{75546}{(0.995 \times 1.011)}$			$N \times 0.995 \times 1.011$ = Jan **or**
				$N \times 0.995 \times 1.011 = 175546$ **or**
			M1	0.995×1.011 (accept values to 2 decimal places for this mark)
	$N = 174508.54$	Greater and 174508.54	A1	A1 174508 – 174509 **or** 1.00594 – 1.00595
			C1	C1 conclusion consistent with value found (this mark is dependent on previous M1)

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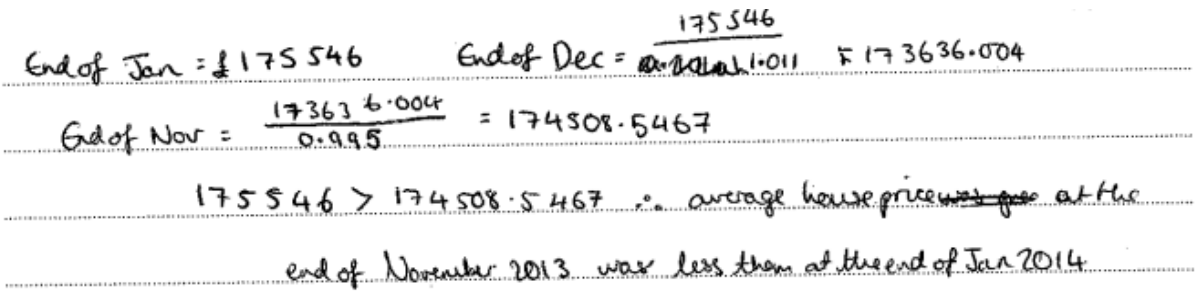
Responses

Student response 1

Refer to **data sources A, B and C** in the source booklet for Questions 2 to 5.

2 Determine whether the average house price at the end of November 2013 was greater or less than the average house price at the end of January 2014.

(3)


End of Jan = £175 546
End of Dec = 175546 / 1.011 = 173636.004
End of Nov = 173636.004 / 0.995 = 174508.5467
175546 > 174508.5467 ∴ average house price was at the end of November 2013 was less than at the end of Jan 2014

Examiner comments

A fully correct solution with an appropriate conclusion.

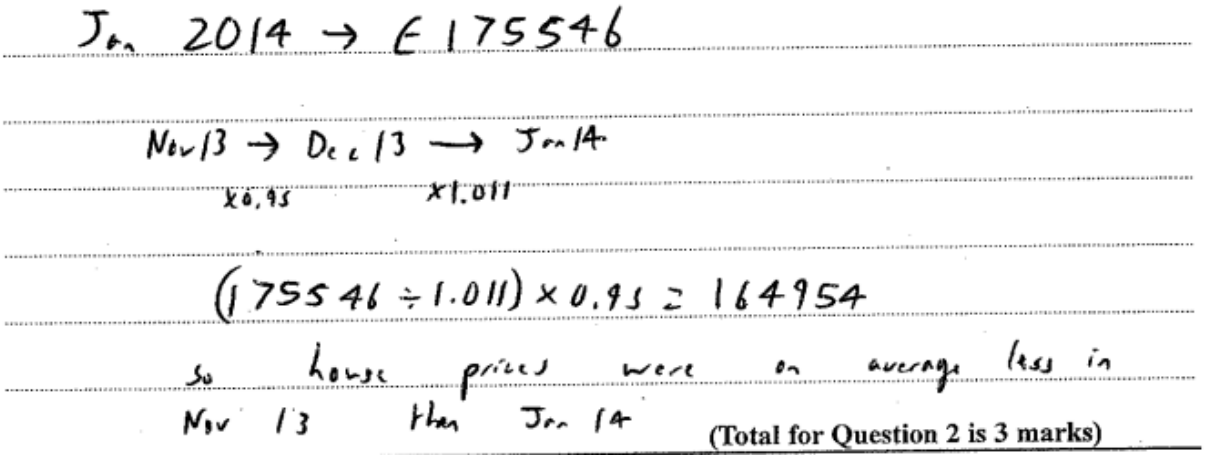
3 marks awarded (3/3)

Student response 2

Refer to **data sources A, B and C** in the source booklet for Questions 2 to 5.

2 Determine whether the average house price at the end of November 2013 was greater or less than the average house price at the end of January 2014.

(3)


Jan 2014 → £175546
Nov 13 → Dec 13 → Jan 14
x0.95 x1.011
(175546 ÷ 1.011) × 0.95 = 164954
so house prices were on average less in Nov 13 than Jan 14

(Total for Question 2 is 3 marks)

Examiner comments

The method indicated in the 'flow chart' is correct. The candidate has then started to reverse the processes in the line below but has multiplied rather than divided by 0.95.

2 marks awarded (2/3)

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Student response 3

Refer to **data sources A, B and C** in the source booklet for Questions 2 to 5.

2 Determine whether the average house price at the end of November 2013 was greater or less than the average house price at the end of January 2014.

(3)

Average of £175546 in 2014
rose by 7·3% since last year even though it fell
Sorts by 0·5% in December.
So it is bigger in Jan 2014 than in Nov 2013

Examiner comments

This candidate has used an incorrect method so no marks can be awarded.

0 marks awarded (0/3)

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Exemplar question 3

3 (a) Work out an estimate for the average house price in London in 1983.

(3)

The EY Item Club predicted that the average house price in London will rise to £600 000 by 2018.

(b) If the EY Item Club is correct, will the average house price have risen at a greater average annual percentage rate between 1983 and 2014 or between 2014 and 2018?

State two assumptions that you have made.

(6)

Mark scheme

Question	Working	Answer	Mark	Notes
3. (a)	$\frac{17021}{147000}$		M1	$\frac{17021}{147000}$ or equivalent
	$\frac{17021}{147000} \times 458000$		M1	$\frac{17021}{147000} \times 458000$ or equivalent
		£53 031.41	A1	for £53 031 (accept awrt) or £53 000 **or** £53 031.41
(b)	$458000 \times n^4 = 600\,000$		M1	$458000 \times n^4 = 600\,000$ **or** '53 031.41' $\times n^{31} = 458\,000$
	$n = \left(\frac{600000}{485000}\right)^{\frac{1}{4}}$ $\left(\frac{600000}{485000}\right)^{0.25}$		M1	one correct expression with n the subject ($n =$)
	$n = 1.0698464$	1.0698464…	A1	one correct answer 1.0698464… **or** 1.0720234 …
	'53 031.4' $\times n^{31} = 458\,000$ $n = \left(\frac{458000}{'53031.4'}\right)^{\frac{1}{31}}$ $n = 1.0720234$	and 1.0720234…	C1	both values correct and a correct conclusion
		first valid assumption	C1	one valid assumption, e.g. the house prices given are exact and have not been rounded to the nearest thousand
		second valid assumption	C1	a second valid assumption, e.g. the average house prices are proportional to the property values given in the table

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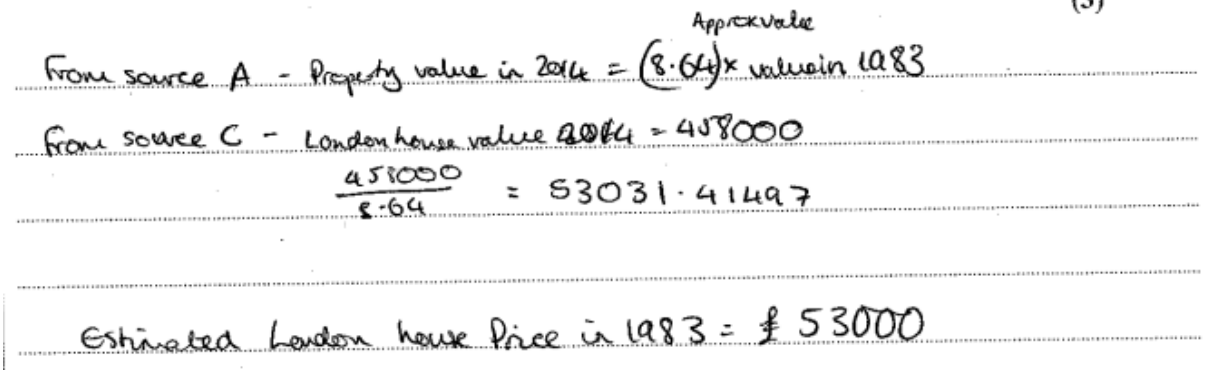
Responses for part (a)

Student response 1

3 (a) Work out an estimate for the average house price in London in 1983.

(3)


Approx value
From source A - Property value in 2014 = (8.64) × value in 1983
From source C - London house value 2014 = 458000
458000 / 8.64 = 53031.41497
Estimated London house Price in 1983 = £53000

Examiner comments

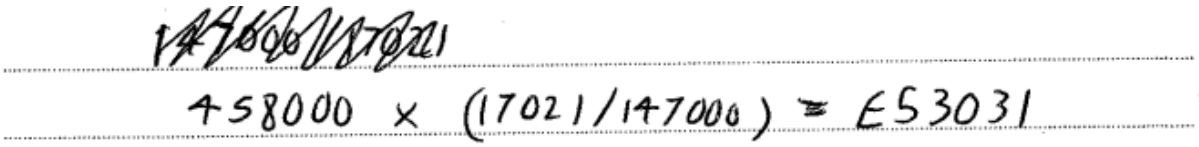
A fully correct method and answer. The accurate answer is £53031.41 but, given the context, an answer of £53000 is perfectly acceptable. The candidate has used the figure 8.64 in their calculation; whilst it isn't shown where this figure has come from (147000/17021) the final answer is correct so full marks are awarded. However, candidates would be well advised to show all calculations as part of their working.

3 marks awarded (3/3)

Student response 2

3 (a) Work out an estimate for the average house price in London in 1983.

(3)



Examiner comments

A fully correct method and answer. The accurate answer is £53031.41 but, given the context, an answer of £53031 is perfectly acceptable.

3 marks awarded (3/3)

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Responses for part (b)

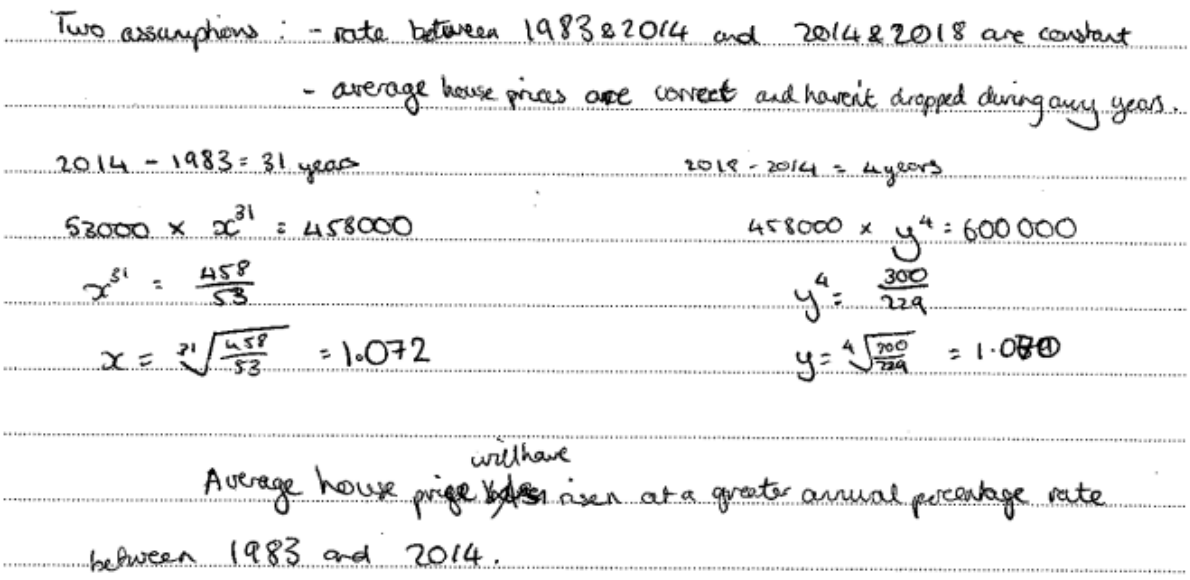
Student response 1

The EY Item Club predicted that the average house price in London will rise to £600 000 by 2018.

(b) If the EY Item Club is correct, will the average house price have risen at a greater average annual percentage rate between 1983 and 2014 or between 2014 and 2018?

State two assumptions that you have made.

(6)


Two assumptions : - rate between 1983 & 2014 and 2014 & 2018 are constant
- average house prices are correct and haven't dropped during any years.
2014 - 1983 = 31 years
2018 - 2014 = 4 years
53000 × x^31 = 458000
458000 × y^4 = 600 000
x^31 = 458/53
y^4 = 300/229
x = 31√(458/53) = 1.072
y = 4√(300/229) = 1.080
Average house price will have risen at a greater annual percentage rate between 1983 and 2014.

Examiner comments

The solution given is a correct one with an appropriate conclusion. The first assumption made by the candidate relates to their solution where they have indeed assumed that the rate is constant each time. However, the second assumption given is not appropriate.

5 marks awarded (5/6)

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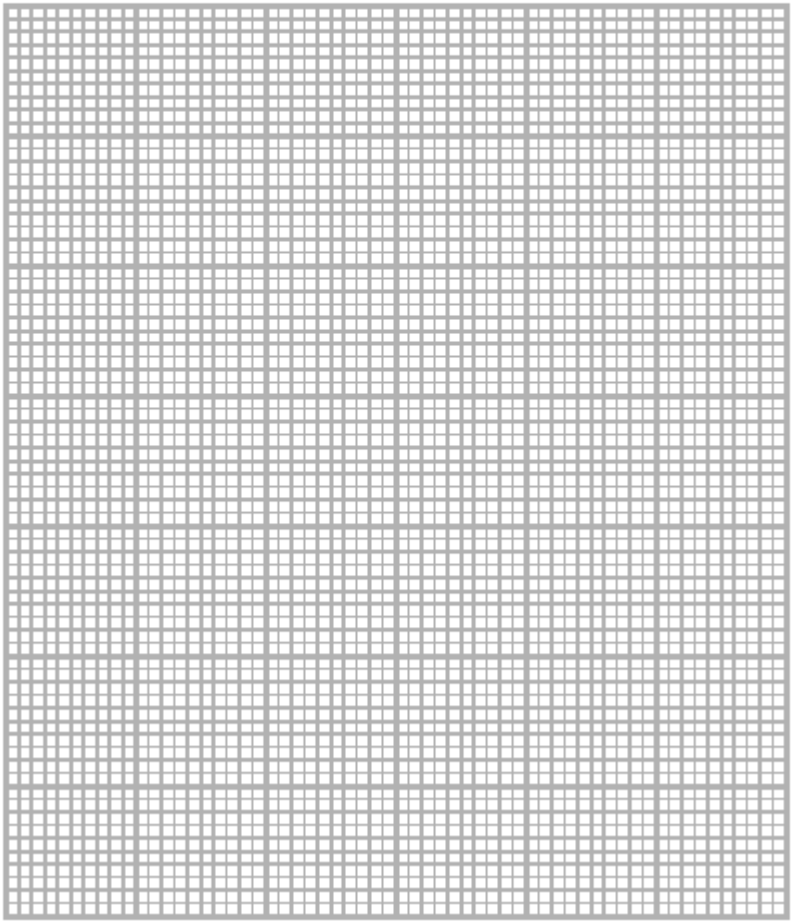
Exemplar question 4

4 By considering the data in the bar chart in **data source C** in the source booklet:

(a) draw an appropriate diagram on the graph paper provided below in order to determine the nature of the correlation between house prices in February 2014, £x, and the increase from 2013, £y, shown in brackets.

(4)



The equation of the line of regression of y on x is

$$y = 0.1734x - 23871$$

The correlation coefficient $r = 0.955$

(b) Interpret this information.

(3)

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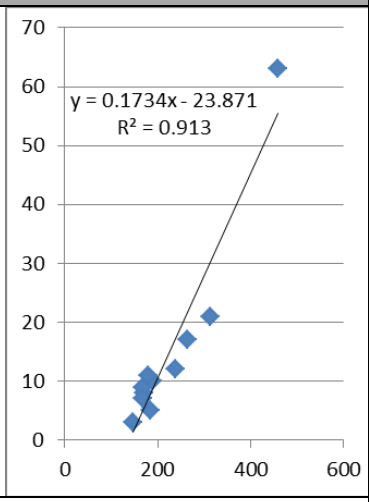
Mark scheme

Question	Working	Answer	Mark	Notes
4. (a)		Correct diagram	M1 M1 A1 B1	scatter graph at least 5 points plotted correctly all points plotted correctly consistent linear scale on both axes
(b)		Valid comment for gradient in context Valid comment for intercept in context Valid comment for correlation coefficient in context	C1 C1 C1	valid comment for the gradient in context, e.g. the more expensive the house the greater the increase in price valid comment for the intercept in context, e.g. using 2014 prices rather than the 2013 prices valid comment for the correlation coefficient, e.g. very high linear correlation between 2014 prices and increase in price

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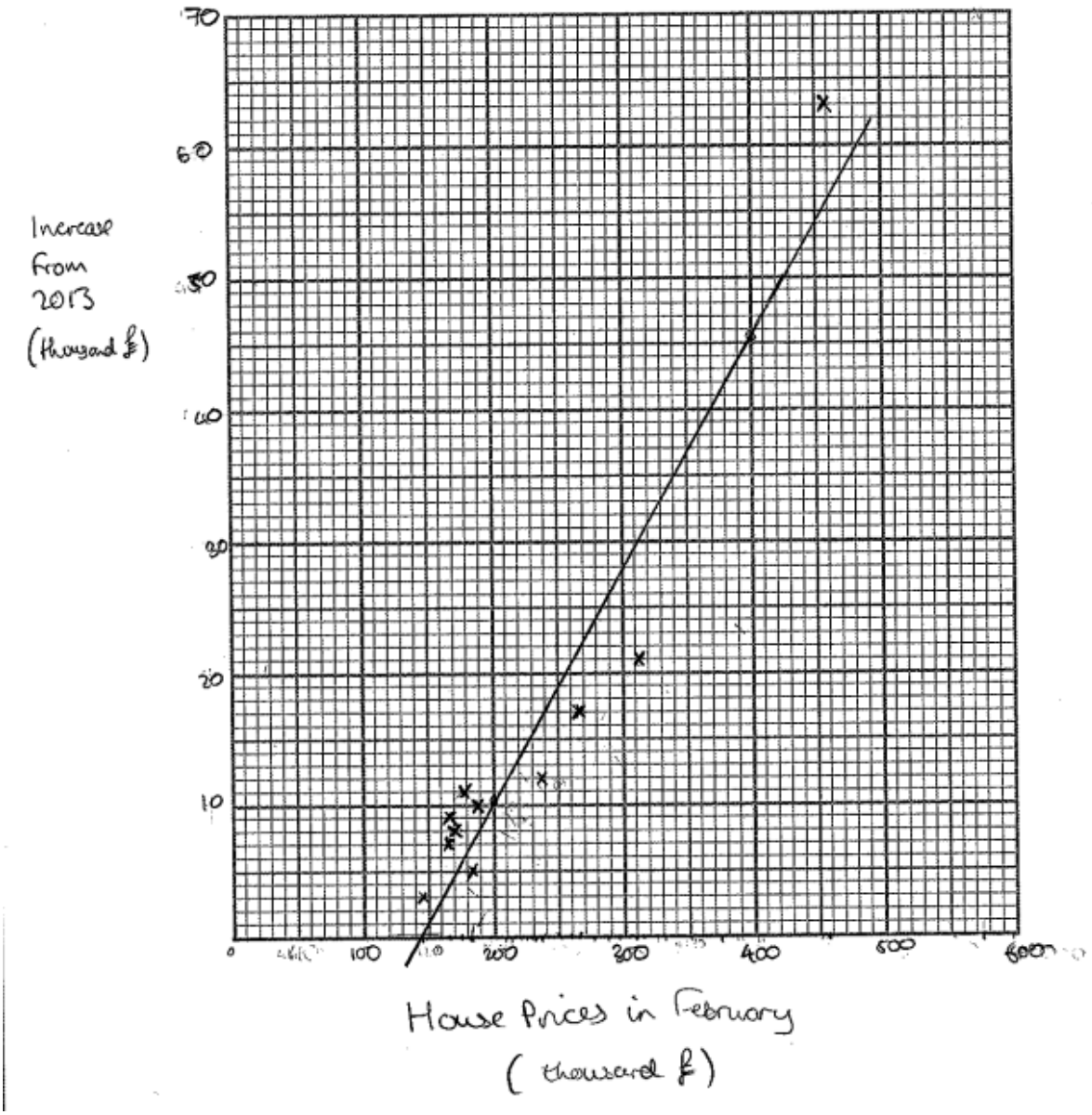
Responses for part (a)

Student response 1

4 By considering the data in the bar chart in **data source C** in the source booklet:

(a) draw an appropriate diagram on the graph paper provided below in order to determine the nature of the correlation between house prices in February 2014, £x, and the increase from 2013, £y, shown in brackets.

(4)



Examiner comments

An appropriate diagram with both axes scaled and labelled.

4 marks awarded (4/4)

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Responses for part (b)

Student response 1

The equation of the line of regression of y on x is

$$y = 0.1734x - 23871$$

The correlation coefficient $r = 0.955$

(b) Interpret this information.

(3)

$\bar{y} = £15091$ $\bar{x} = 224727$

The line is distorted by London.

The more expensive houses increased more than between 2013 & 2014.

The data is very close to the line of regression.

Examiner comments

At this level, interpretations should be given in context. There were 3 marks available for this part of the question and three figures to be interpreted. This candidate has made an attempt at interpretation but has not explained which figure is being interpreted each time.

0 marks awarded (0/3)

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Paper 2: Applications

Section A: Eurovision

Exemplar question 1

2 A summary of the point scores awarded to Austria and the Netherlands is shown in the tables below.

Austria

Score	0	1	2	3	4	5	6	7	8	10	12
Frequency		1	1	1	1	2	1	2	3	7	13

$\sum fx = 290$ $\sum fx^2 = 2978$

Table 1

The Netherlands

Score	0	1	2	3	4	5	6	7	8	10	12
Frequency	9	0	2	2	2	0	0	2	5	7	8

$\sum fx = 238$ $\sum fx^2 = 2328$

Table 2

The information in tables 1 and 2 has been partially summarised in table 3

Figures have been written correct to 3 significant figures where appropriate.

	Median	**Mean**	**Range**	**Standard Deviation**
Austria	10	7.84	12	4.37
The Netherlands				

Table 3

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(a) (i) Complete the missing entry in table 1

(ii) Complete the 4 missing entries in table 3

Those for Austria have already been done.

(8)

In order to encourage countries with low scores, it is proposed that all scores have 10 added to them.

(b) Describe what effect this proposal would have on the values for Austria in table 3

(2)

An alternative proposal is to double all the scores.

(c) Describe what effect this proposal would have on the values for Austria in table 3

(2)

Mark scheme

Question	Working	Answer	Mark	Notes
2. (a)(i)		5	B2	B2 cao
(ii)	Median is $\frac{(37+1)}{2}$ = 19th value	8	M1	$\Sigma fx / \Sigma f$
	Mean = $\frac{238}{37}$ = 6.432	6.43	A1	mean = (accept awrt) 6.43
	Range 0 to 12 or 12	0–12 or 12	B1	B1 range is 0 to 12 or 12
	SD: $\frac{2328}{37} - \left(\frac{238}{37}\right)^2$		M1	use of correct formula for variance
	√21.54...	4.641415	M1 A1	square root (accept awrt) 4.64
(b)		The range and the SD would be unaffected The mean and the median would increase by 10	C1 C1	for range and SD unaffected (or equivalent) for mean and median increased by 10 (or equivalent)
(c)		The range and the SD would increase The mean and the median would be doubled	C1 C1	for range and SD increased (or equivalent) for mean and median doubled (or equivalent)

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Responses for part (a)

Student response 1

(a) (i) Complete the missing entry in table 1

5

(ii) Complete the 4 missing entries in table 3

Those for Austria have already been done.

Median → $n = 37$ $\frac{37+1}{2} = 19$

19^{TH} value $= 8$

mean → $\frac{(2\times2)+(2\times3)+(2\times4)+(2\times7)+(5\times8)+(7\times10)+(8\times12)}{37}$

$= 6.43$

Standard deviation → $= \frac{\Sigma x^2}{37} - \left(\frac{238}{37}\right)^2$

$\frac{2328}{37} - 6.43^2 = \sqrt{21.57}$

$= 4.64$

(8)

$\Sigma x^2 = (2\times4)+(2\times9)+(2\times16)+(2\times49)+(5\times64)+(7\times100)+(8\times144)$

$= 2328$

62.91
41.34
21.55

Examiner comments

A fully correct solution with all working out clearly shown.

8 marks awarded (8/8)

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Student response 2

(a) (i) Complete the missing entry in table 1

total number of countries voting = 37

frequency = 32.

37 - 32 = 5

(ii) Complete the 4 missing entries in table 3

Those for Austria have already been done.

mean = $\frac{\Sigma fx}{\Sigma f}$ = $\frac{238}{(9+2+2+2+2+5+7+3)}$ = 6.43

range = 12 - 0 = 12.

median = $\frac{\Sigma f + 1}{2}$ = 19th value.

19th value = 7.

standard deviation = $\sqrt{\left[\frac{\Sigma (x-\bar{x})^2}{n}\right]}$

$\Sigma (x-\bar{x})^2$ = 156.9139 n = 11.

1569139 / 11 = 14.2649

$\sqrt{14.2649}$ = 3.78

(8)

Examiner comments

The first few calculations are shown as correct. The candidate has quoted a formula for standard deviation but has not shown any working other than an incorrect answer. Candidates are advised to show numbers substituted into formulae and their subsequent calculations. This candidate did decide to use the alternative formula for standard deviation. The better formula to use would be the formula given on the formula sheet as the summary statistics given in the question could then be used.

4 marks awarded (4/8)

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Responses for part (b)

Student response 1

In order to encourage countries with low scores, it is proposed that all scores have 10 added to them.

(b) Describe what effect this proposal would have on the values for Austria in table 3

(2)

Median would be unchanged.
mean would be increased to 8.11
Range would be unchanged.
Standard deviation would be increased.

Examiner comments

Although no working was necessary in order to gain full marks in this question, candidates could have tried out adding 10 to a small set of numbers to determine the answer. This candidate may have tried to work out the mean again but arrived at the wrong value of 8.11

1 mark awarded (1/2)

Student response 2

In order to encourage countries with low scores, it is proposed that all scores have 10 added to them.

(b) Describe what effect this proposal would have on the values for Austria in table 3

(2)

No effect as all scores have had 10 added to them. Values are not closer to the mean, so standard deviation does not change. No change in standard deviation value or range value, ~~[illegible]~~
The mean will increase ~~[illegible]~~. and the median will increase.

Examiner comments

A fully correct solution.

2 marks awarded (2/2)

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Responses for part (c)

Student response 1

An alternative proposal is to double all the scores.

(c) Describe what effect this proposal would have on the values for Austria in table 3

(2)

Range would double.
Median would double
Mean would double.
S.D would double.

Examiner comments

A fully correct solution.

2 marks awarded (2/2)

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Exemplar question 2

3 Compare the results of the two countries.

(4)

Mark scheme

Question	Working	Answer	Mark	Notes
3.	Austria higher mean and median		C2	Austria had a higher mean and median so did better (or equivalent) (C1 for reference to just one measure of location and interpretation)
	Higher mean than Netherlands	Full comparison	C2	Austria had a lower SD so the variation of scores was less (C1 for just a reference to SD with no interpretation)

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Responses

Student response 1

3 Compare the results of the two countries.

(4)

Austria's results were more consistent as the standard deviation is lower ($4.37 < 4.64$) $\Leftrightarrow$ data closer together around mean. Austria's results are also generally higher than those of The Netherlands because both the median ($10 > 8$) and the mean ($7.84 > 6.43$) are higher.

For the same range $\Rightarrow$ so results directly comparable.

In conclusion: Austria had consistently higher results than The Netherlands, as mean was higher and results were all closer to the higher mean due to lower standard deviation).

(Total for Question 3 is 4 marks)

TOTAL FOR SECTION A IS 20 MARKS

Examiner comments

A very comprehensive answer with all comparisons carried out in context with an interpretation and with each statement related to a statistical measure.

4 marks awarded (4/4)

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Student response 2

3 Compare the results of the two countries.

(4)

on average, Austria performed better than The Netherlands. For example, the ~~average~~ mean score recieved by Austria was ~~7.84~~ 7.84, nowever the mean score recieved by the Netherlands was 6.43.

Examiner comments

This candidate has given one interpretation that 'Austria performed better than the Netherlands' and related this to the higher mean score received by Austria. Candidates would be advised to look at the number of marks available for the question; four marks were available in this instance. It is advisable to look to compare both a measure of central tendency and a measure of spread.

2 marks awarded (2/4)

Student response 3

3 Compare the results of the two countries.

(4)

Austria and the Netherlands have the same range, 12, however Austria has a higher mean of 7.84, to 6.43 and a higher median of 10, to 8. However The Netherlands has a higher standard deviation of 4.64 compared to Austrias 4.37.

Examiner comments

The candidate has just compared the range, mean, median and standard deviation. No attempt has been made to interpret what this means. At this level, each comparison should be followed by interpretation of what this means in the context of the question.

2 marks awarded (2/4)

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Section B

Task 1: Vaccines and blood groups

Exemplar question 3

4 Kevin teaches at a college.

He carries out a survey of 100 of the students at the college.

He finds out that:

87 students have had the DTP vaccine

77 students have had the Meningitis C (Men C) vaccine

86 students have had the MMR vaccine

75 students have had all three vaccines

2 students have not had any vaccines

2 students have had just the Men C and the MMR vaccine

No students have had just the DTP and MMR vaccines

(a) Work out the probability that a student, chosen at random, has had only the DTP vaccine.

(5)

(b) Two students are chosen at random.

Work out the probability that both students have received fewer than two of the vaccines.

(3)

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Mark scheme

Question	Working	Answer	Mark	Notes
4.(a)	Appropriate Venn diagram with 3 intersecting circles within a rectangle		M1	M1 for 3 intersecting circles within a rectangle
			M1	M1 for any 3 of 75, 2, 2, and 0 in correct positions
	Correct values displayed in the appropriate areas of the diagram		M1	M1 for at least 2 correct calculated values
			M1	M1 for completely correct diagram
	Correct probability stated 0.12	0.12	A1	A1 ft diagram their $\frac{'12'}{100}$
	or n(D or C or R) = n (D) + n(C) + n(R) – n(D&C) – n(D&R) – n(C&R) + n(D&C&R)		M1	**or** M1 for correct statement of inclusion/exclusion relation
	100 – 2 = 87 + 77 + 86 – n(D&C) – n(D&R) – n(C&R) + 75		M1	M1 for correct substitution of given values
	n(C&R) = 77, (D&R) = 75 n(D&C) = 75		M1	M1 for n(C&R) = 77, (D&R) = 75
			M1	M1 for n(D&C) = 75
		0.12	A1	A1 **ft** diagram their $\frac{'12'}{100}$
(b)			M1	for consideration of students receiving 0 vaccines and/or 1 vaccine
	$\frac{23}{100}\times\frac{22}{99}$		M1	for $\frac{23}{100}\times\frac{22}{99}$ (or equivalent)
	$= \frac{23}{450}$ or $0.051\dot{}$	$\frac{23}{450}$	A1	for $\frac{23}{450}$ or $0.051\dot{}$ (or equivalent)

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Responses for part (a)

Student response 1

4 Kevin teaches at a college.

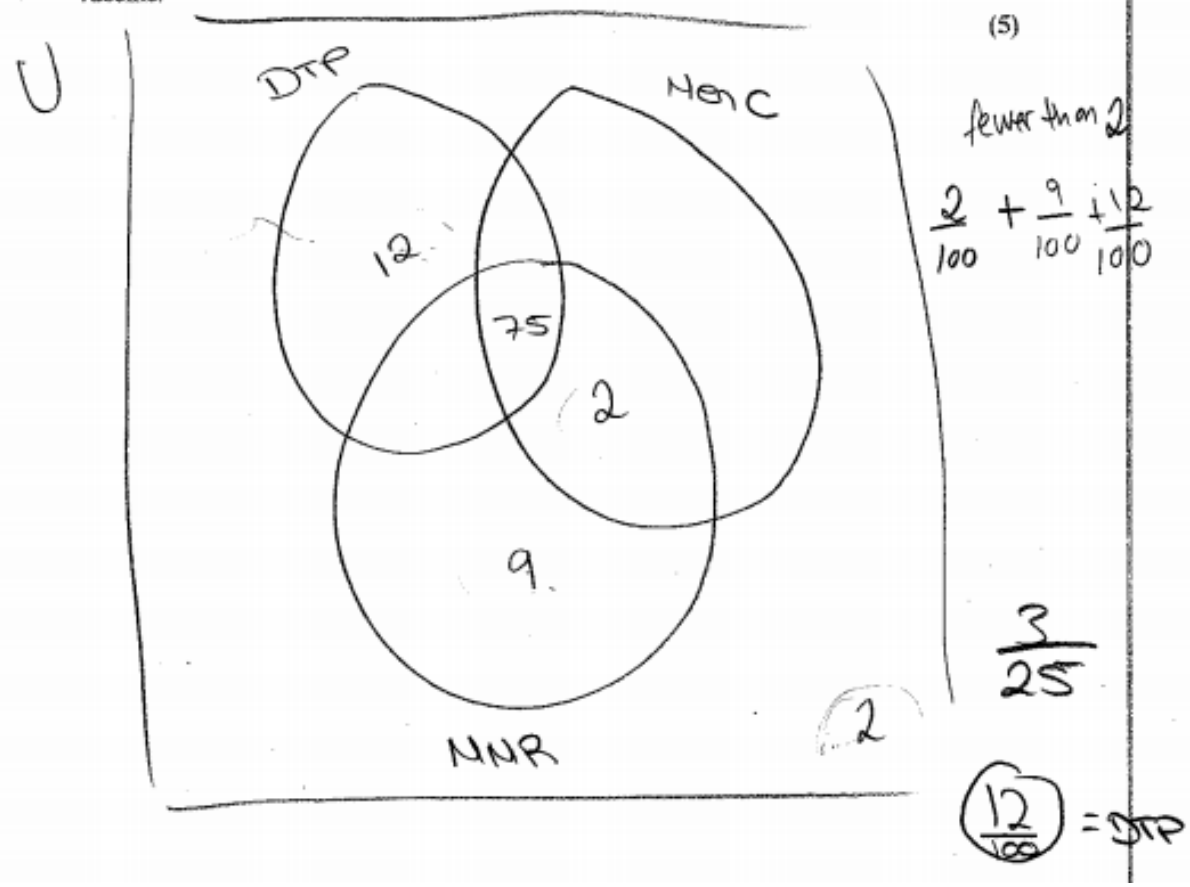
He carries out a survey of 100 of the students at the college.

He finds out that:

87 students have had the DTP vaccine
77 students have had the Meningitis C (Men C) vaccine
86 students have had the MMR vaccine
75 students have had all three vaccines
2 students have not had any vaccines
2 students have had just the Men C and the MMR vaccine
No students have had just the DTP and MMR vaccines

(a) Work out the probability that a student, chosen at random, has had only the DTP vaccine.

(5)



Examiner comments

A fully correct solution. The candidate here has circled their answer but it is easy to overlook. Candidates should ensure that their answers are always explicitly identified.

5 marks awarded (5/5)

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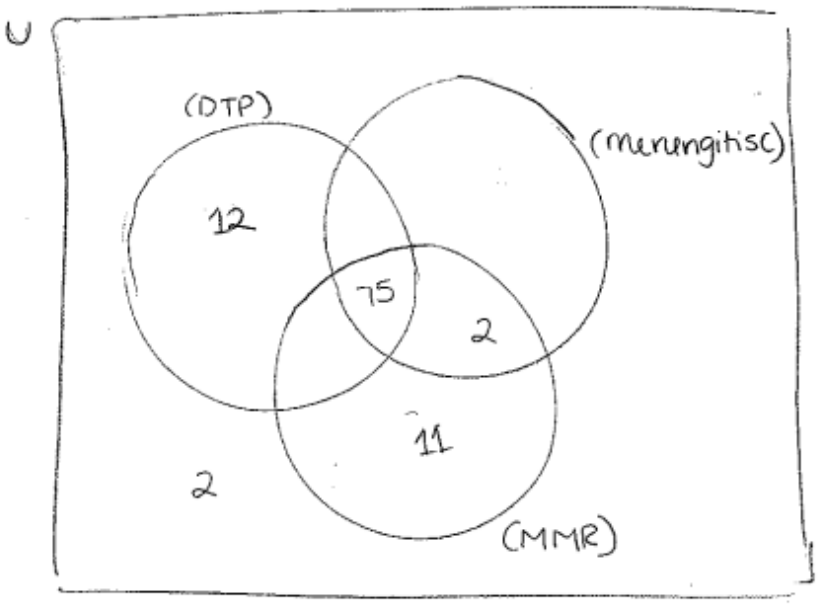
Student response 2

(a) Work out the probability that a student, chosen at random, has had only the DTP vaccine.

(5)



$\frac{12}{100}$ has had only the DTP

Examiner comments

A fully correct solution with the answer easily identified in a sentence. It is, however, worth noting that the candidate has left all the zeros off their Venn diagram. As the question did not ask for a Venn diagram to be drawn this is acceptable but if the question had explicitly asked for a Venn diagram to show the given information then all zeros should be inserted in the diagram.

5 marks awarded (5/5)

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Student response 3

4 Kevin teaches at a college.

He carries out a survey of 100 of the students at the college.

He finds out that:

87 students have had the DTP vaccine

77 students have had the Meningitis C (Men C) vaccine

86 students have had the MMR vaccine

75 students have had all three vaccines

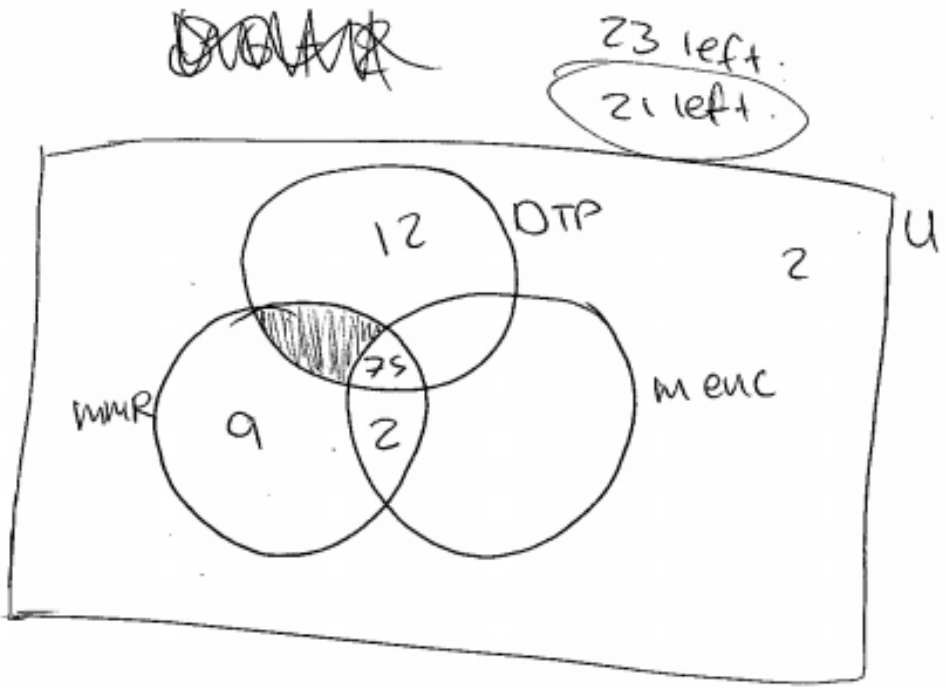
2 students have not had any vaccines

2 students have had just the Men C and the MMR vaccine

No students have had just the DTP and MMR vaccines

(a) Work out the probability that a student, chosen at random, has had only the DTP vaccine.

(5)



Examiner comments

The Venn diagram is correct but the candidate has not answered the question. Candidates should ensure that they do answer the question.

3 marks awarded (3/5)

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Responses for part (b)

Student response 1

(b) Two students are chosen at random.

Work out the probability that both students have received fewer than two of the vaccines.

(3)

$\frac{2}{100} + \frac{9}{100} + \frac{12}{100} = \frac{23}{100}$

there's a 23% chance that both students have recieved fewer than two of the vaccine.

Examiner comments

This candidate has made a start to the question and got far enough to gain a method mark for 23/100. However, only one student has been considered.

1 mark awarded (1/3)

Student response 2

(b) Two students are chosen at random.

Work out the probability that both students have received fewer than two of the vaccines.

(3)

$11 + 12 + 2 = \frac{25}{100}$

Examiner comments

An attempt has been made at the question but the probability obtained is not correct.

0 marks awarded (0/3)

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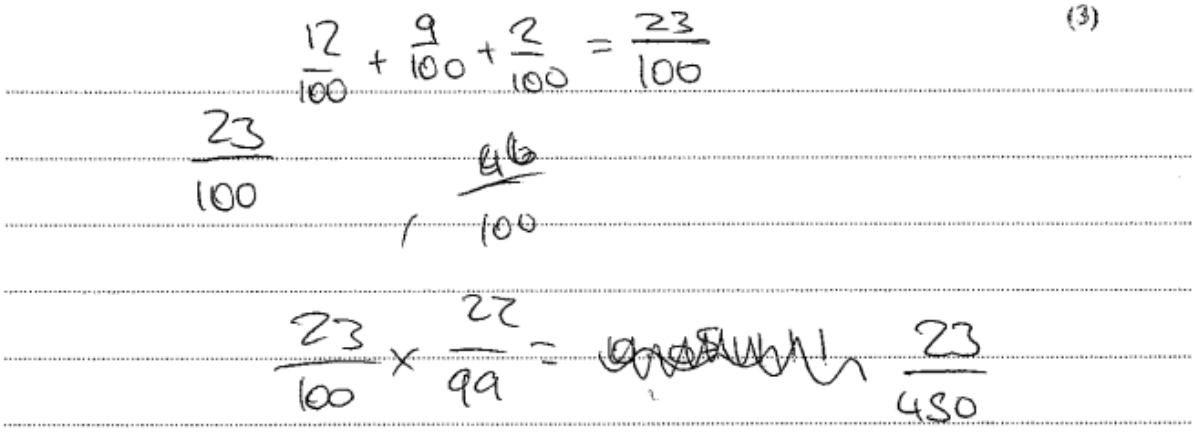
Student response 3

(b) Two students are chosen at random.

Work out the probability that both students have received fewer than two of the vaccines.

(3)



Examiner comments

A fully correct solution.

3 marks awarded (3/3)

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Exemplar question 4

5 The MMR vaccine protects against measles, mumps and rubella.

In Kevin's survey of 100 students, 86 of them have had the MMR vaccine.

If a student has received the vaccine then the probability that they will get measles is 0.01
If a student has **not** received the vaccine then the probability that they will get measles is 0.9

One of the 100 students in Kevin's sample is chosen at random.
Work out the probability that this student will get measles.

(4)

Mark scheme

Question	Working	Answer	Mark	Notes
5.	1 – 0.86 (= 0.14)		M1	for P(MMR′) = 1 – 0.86 (= 0.14) (may be seen on a tree diagram)
	0.86 × 0.01 **or** 0.14 × 0.9 (= 0.126)		M1	for P(MMR ∩ M) = 0.86 × 0.01 **or** P(MMR′ ∩ M) = 0.14 × 0.9
	0.86 × 0.01 + 0.14 × 0.9		M1	for 0.86 × 0.01 + 0.14 × 0.9
	= 0.1346	0.1346	A1	for 0.1346 – may be rounded to 2 or more significant figures

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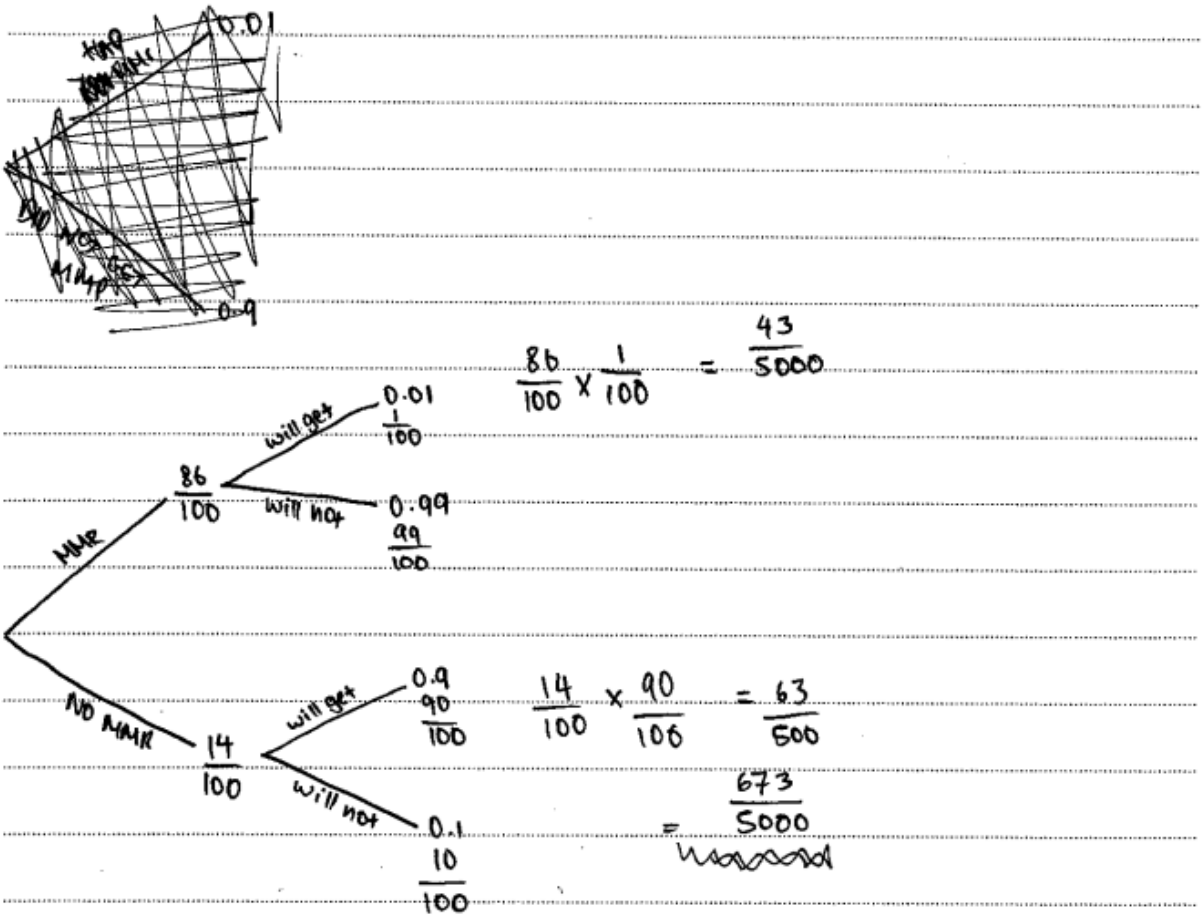
Responses

Student response 1

One of the 100 students in Kevin's sample is chosen at random.
Work out the probability that this student will get measles.

(4)



Examiner comments

A fully correct solution from a correctly constructed probability tree diagram.

4 marks awarded (4/4)

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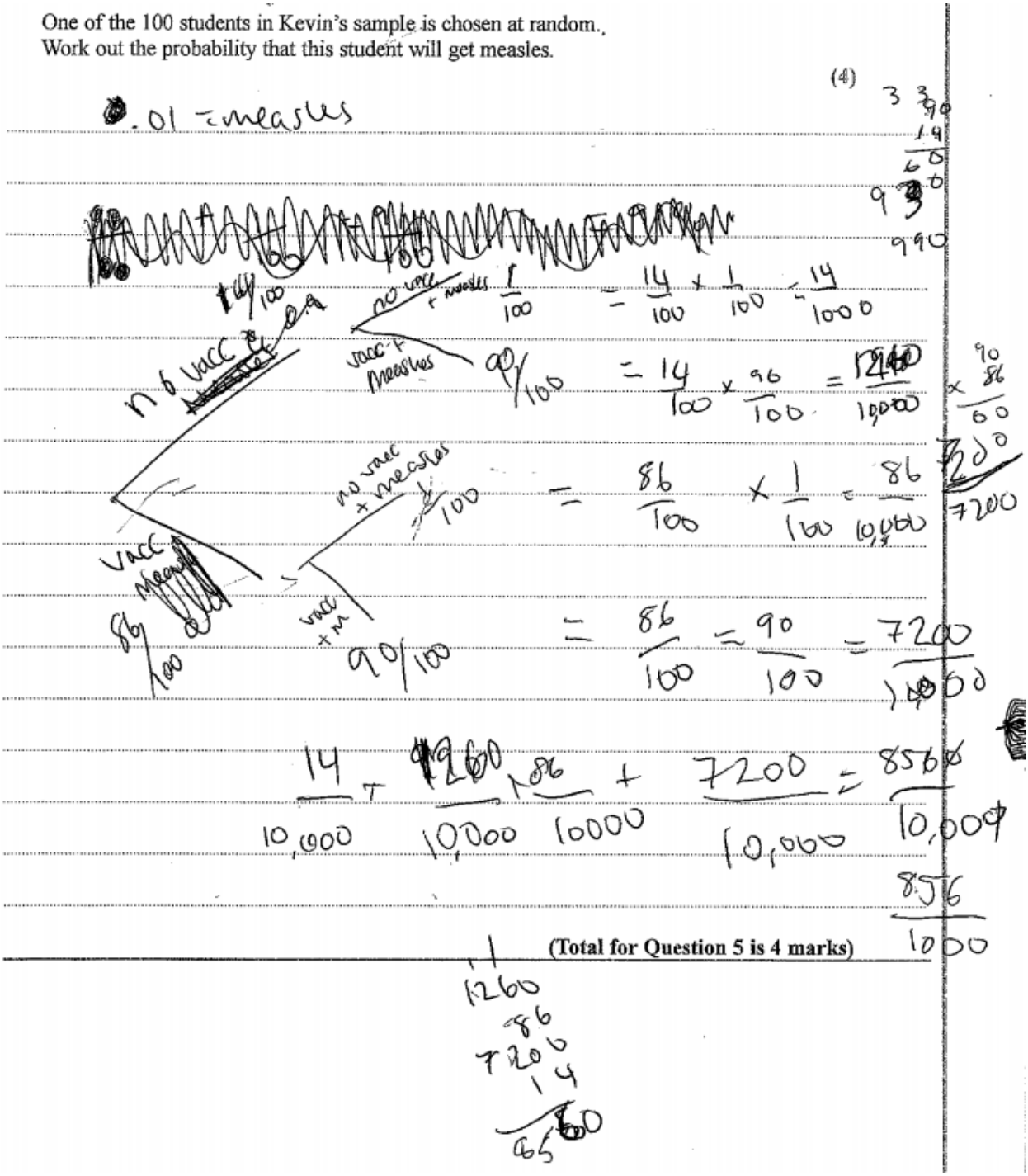
Student response 2


One of the 100 students in Kevin's sample is chosen at random.
Work out the probability that this student will get measles.
(4)
.01 = measles
(Total for Question 5 is 4 marks)

Examiner comments

Although it isn't very easy to read, the candidate has constructed a correct tree diagram. All products from the probability tree diagram have been given but then it appears that all products have been added rather than just the two needed to answer the question.

2 marks awarded (2/4)

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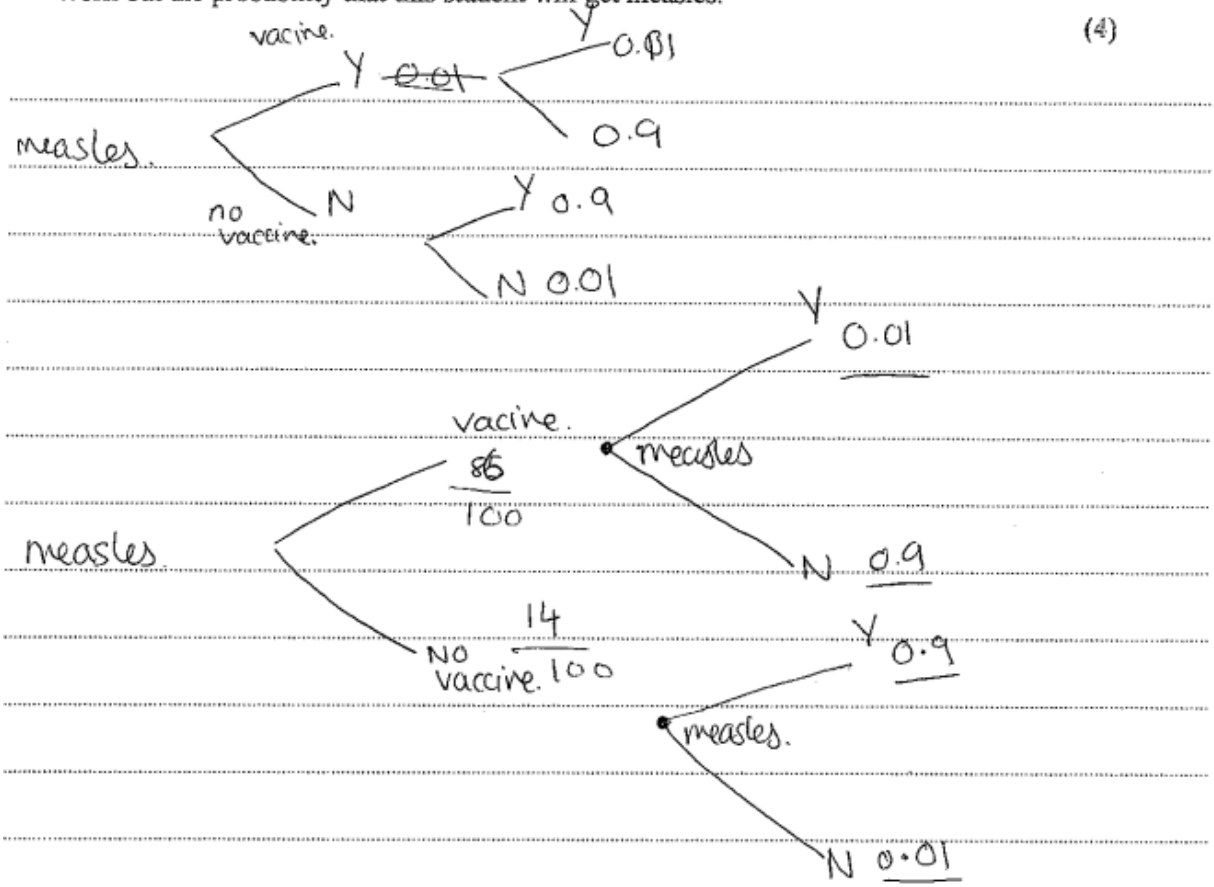
Student response 3

One of the 100 students in Kevin's sample is chosen at random.
Work out the probability that this student will get measles.

(4)



Examiner comments

The probability tree diagram has been constructed correctly but has not been used. As the probability of 0.14 is seen on the tree diagram under 'no vaccine' the first method mark can be awarded.

1 mark awarded (1/4)

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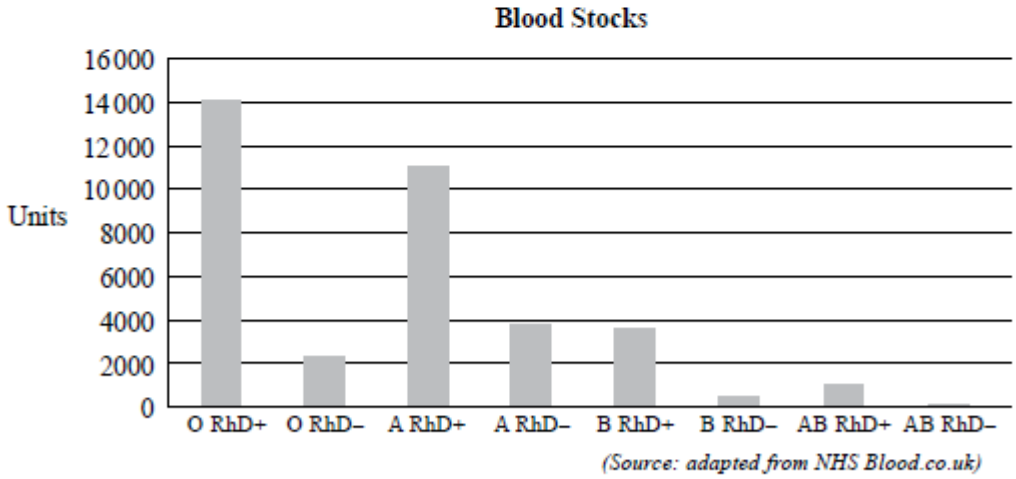
Exemplar question 5

6 Kevin teaches his biology class about blood groups.

Red blood cells sometimes contain a protein known as the RhD antigen. If this is present then the blood group is RhD positive (RhD+). If this is absent then the blood group is RhD negative (RhD–).

UK population		
Blood group	**RhD status**	**Percentage**
O	RhD+	37%
	RhD–	7%
A	RhD+	35%
	RhD–	7%
B	RhD+	8%
	RhD–	2%
AB	RhD+	3%
	RhD–	1%



(Source: adapted from NHS Blood.co.uk)

Blood is normally stored for a maximum of 30 days.
8 000 units of blood are needed each day by hospitals in the UK.

(a) Is there enough of stock B RhD+ blood available for the next 8 days?

(2)

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All the students in Kevin's biology class test their blood to find out their blood group.

The table shows their results.

Kevin's class	
Blood group	**Number of students**
O	13
A	7
B	4
AB	0

A student from Kevin's biology class is picked at random.

(b) Work out an estimate for the probability that this student is RhD–.

(4)

A person is selected at random from the UK population.

(c) Given that this person is RhD+, work out the probability that they have blood group A.

(2)

Mark scheme

Question	Working	Answer	Mark	Notes
6. (a)	3600 ÷ (8000 × 0.08)	No and supporting evidence	M1	M1 (3100 to 3900) ÷ (8000 × 0.08)
			C1	C1* no and a valid reason, e.g. only enough for 4–6 days
	or	No and supporting evidence	M1	M1 8 days × 8000 = 64000 and '64000' × 0.08 = 5120
			C1	C1* no and a valid reason, e.g. 5120 > 3100 to 3900
(b)	$\frac{7}{44} \times 13 + \frac{7}{42} \times 7 + \frac{2}{10} \times 4$		M1	for $\frac{7}{44} \times 13$ or $\frac{7}{42} \times 7$ or $\frac{2}{10} \times 4$
	$= \frac{2663}{660}$ (= 4.03484848…)		M1	for $\frac{7}{44} \times 13 + \frac{7}{42} \times 7 + \frac{2}{10} \times 4$ $(= \frac{2663}{660})$
	Answer above divided by 24		M1	for their answer divided by 24 (their answer must come from 3 calculated fractions)
	$= \frac{2663}{15840} = 0.168$	0.168	A1	for answer in range 0.168 – 0.169 (accept fraction, percentage or decimal)
(c)	0.35 ÷ (0.37 + 0.35 + 0.08 + 0.03)		M1	for 0.35 ÷ (0.37 + 0.35 + 0.08 + 0.03) or 0.35 = 0.83 × P(A ∣ RhD+) or $\frac{n}{83}$
	$= \frac{35}{83}$ or 0.42–0.422	$\frac{35}{83}$	A1	for $\frac{35}{83}$ or 0.42 – 0.422 **oe**

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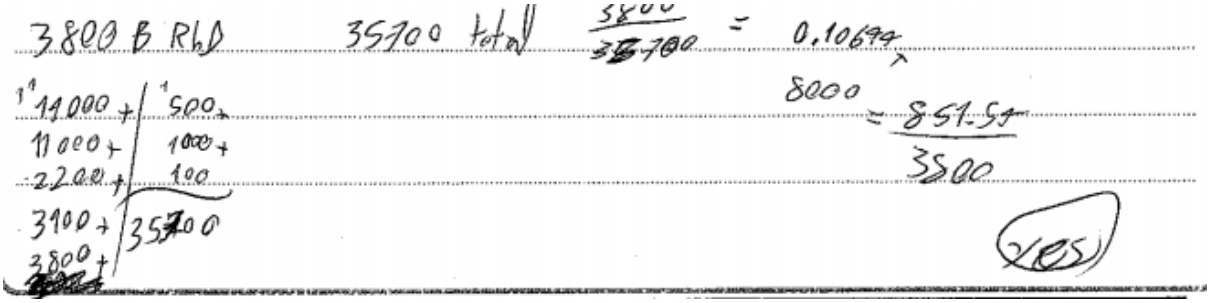
Responses for part (a)

Student response 1

(a) Is there enough of stock B RhD+ blood available for the next 8 days?



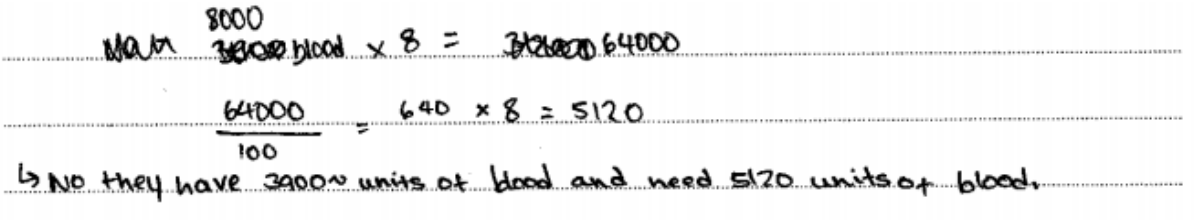
Examiner comments

The calculation shown is incorrect so no marks can be awarded.

0 marks awarded (0/2)

Student response 2

(a) Is there enough of stock B RhD+ blood available for the next 8 days?



Examiner comments

The question asked had been answered; there is correct supporting evidence for the answer so full marks can be awarded.

2 marks awarded (2/2)

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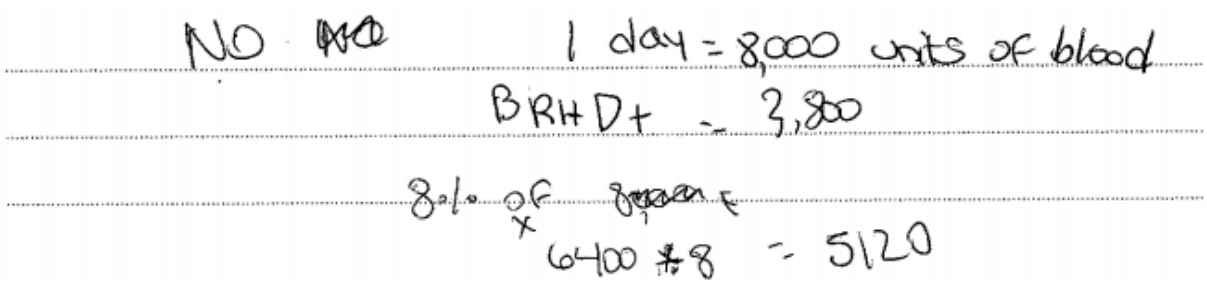
Student response 3

(a) Is there enough of stock B RhD+ blood available for the next 8 days?



Examiner comments

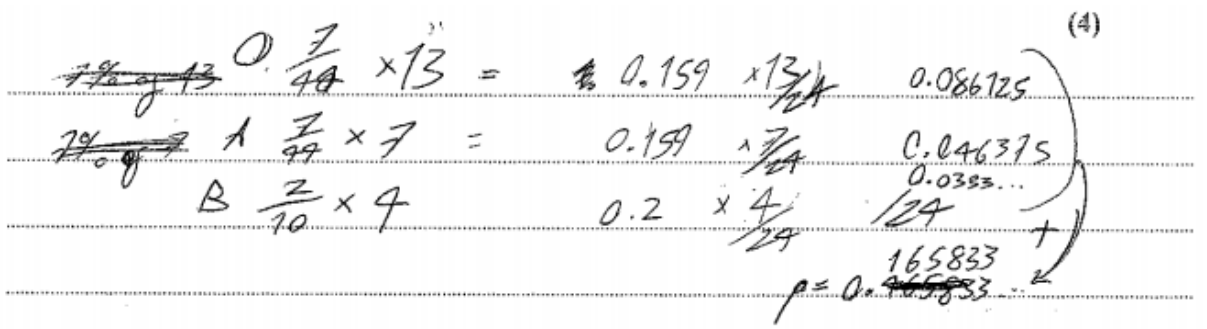
The correct calculations have been done but these have not been linked in with the response of 'no'. At this level, a yes/no answer is not sufficient and must be linked to figures produced in the working.

1 mark awarded (1/2)

Responses for part (b)

Student response 1

(b) Work out an estimate for the probability that this student is RhD–.



Examiner comments

In the calculation, the fraction in the second product has the wrong denominator (44 rather than 42). The three products are evaluated but although division by 24 is seen it is not clear what this refers to. The answer given by the candidate comes from the sum of the three products so only the first method mark can be awarded.

1 mark awarded (1/4)

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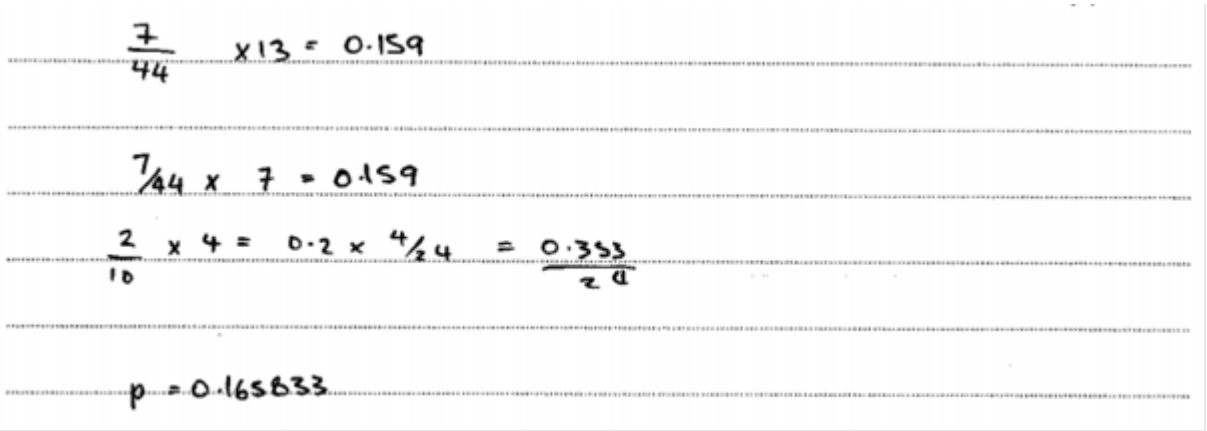
Student response 2

(b) Work out an estimate for the probability that this student is RhD–.



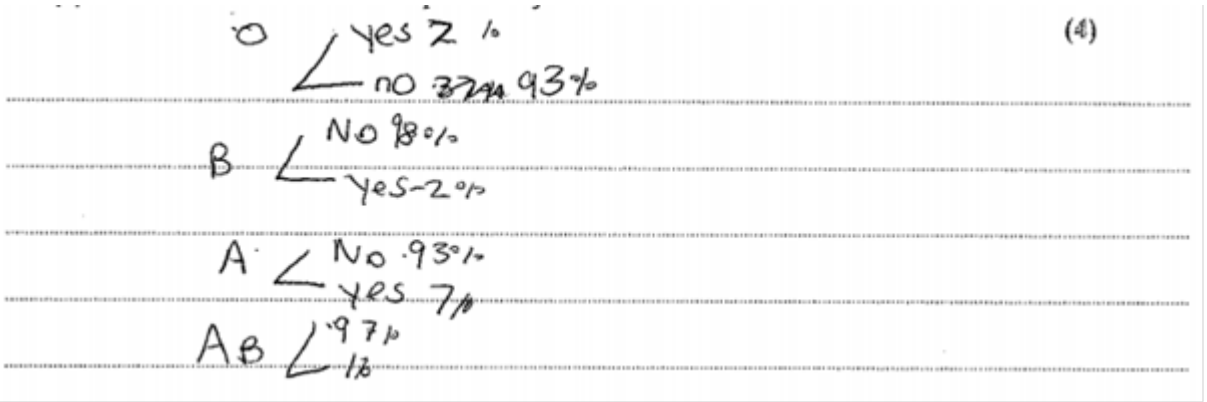
Examiner comments

This candidate has worked out the three products needed. Unfortunately, these have not been added. Instead only the final product rather than the sum of the three products has been divided by 24.

1 mark awarded (1/4)

Student response 3

(b) Work out an estimate for the probability that this student is RhD–.



Examiner comments

No calculations have been shown so no marks can be awarded.

0 marks awarded (0/4)

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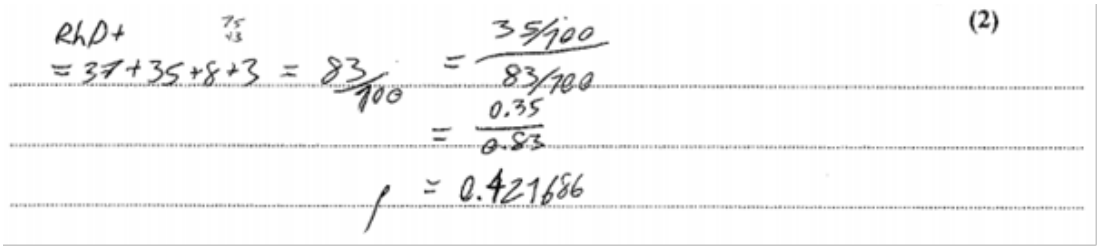
Responses for part (c)

Student response 1

A person is selected at random from the UK population.

(c) Given that this person is RhD+, work out the probability that they have blood group A.

(2)



Examiner comments

A fully correct solution.

2 marks awarded (2/2)

Student response 2

A person is selected at random from the UK population.

(c) Given that this person is RhD+, work out the probability that they have blood group A.

(2)

Examiner comments

This candidate has failed to understand the question and has simply added together the percentages given in the first table.

0 marks awarded (0/2)

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Student response 3

A person is selected at random from the UK population.

(c) Given that this person is RhD+, work out the probability that they have blood group A.

(2)

3 A - 35% RHD +

65% = not Blood grap A

$P(A|B) = P(\frac{A \cap B}{P(B)})$

(Total for Question 6 is 8 marks)

$35 - \frac{38}{35} = 1.085714286$

Examiner comments

The correct formula has been quoted but not used correctly.

0 marks awarded (0/2)

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Task 2: University

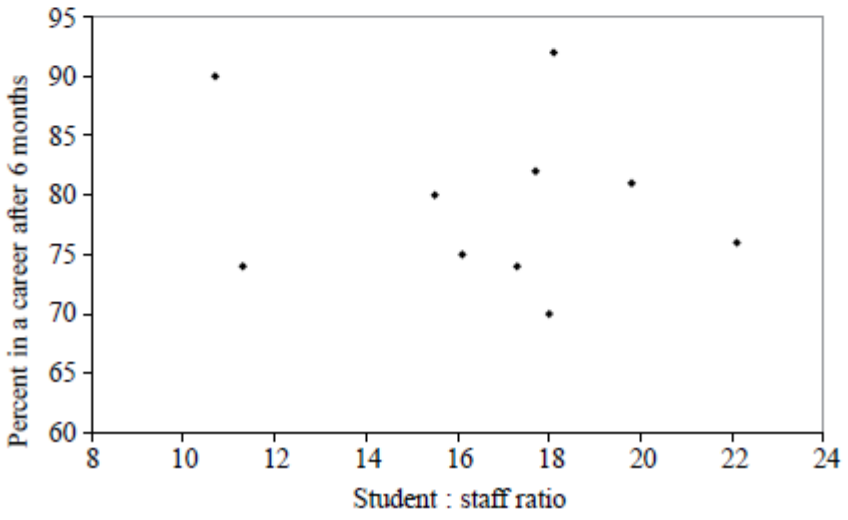
Exemplar question 6

7 Shazia is going to apply to university to study politics.

She finds out this data about politics courses at some universities.

			Student satisfaction: % of students satisfied with				
Rating	**Name of institution**	**Survey score (%)**	**course**	**teaching**	**feedback**	**Student : staff ratio**	**Students in a career after 6 months (%)**
1	Oxford	100.0	93	94	65	11.3 : 1	74
2	St Andrews	99.7	89	93	71	18.1 : 1	92
3	Cambridge	99.2	98	97	75	16.5 : 1	
4	LSE	98.3	87	87	76	10.7 : 1	90
5	UCL	91.5	78	87	66	15.5 : 1	80
6	Durham	85.9	88	87	74	19.8 : 1	81
7	Surrey	85.2	96	93	86	17.5 : 1	
8	Warwick	82.8	89	91	68	17.7 : 1	82
9	KCL	82.3	91	88	69	18.0 : 1	70
10	Birmingham	82.0	86	92	73	22.1 : 1	76
11	Bristol	80.5	80	91	71	16.1 : 1	75
12	York	79.8	86	92	72	17.3 : 1	74

She wants to know if there is any relationship between the student:staff ratio and the percentage of students in a career after 6 months. She starts by using the information from the table to draw a scatter graph.



Data from: www.theguardian.com/education/table/2013/jun/04/university-guide-politics

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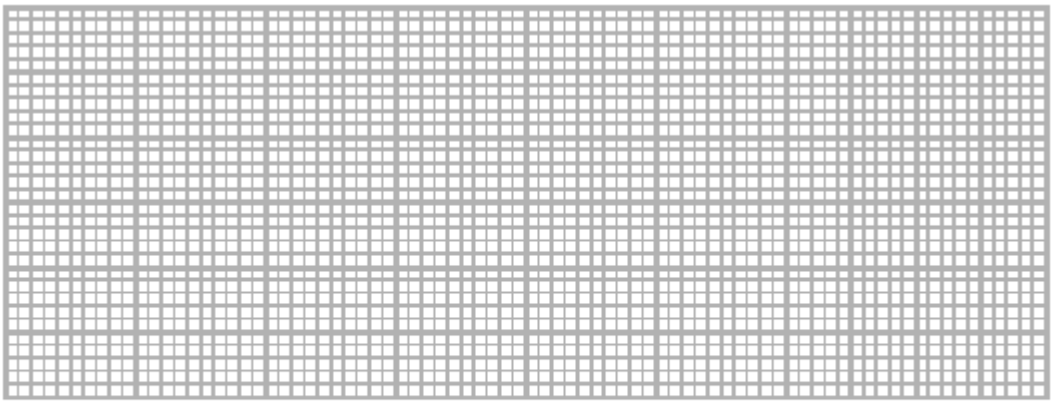
(a) Explain what the scatter graph shows about any relationship between the student:staff ratio and the percentage of students in a career after 6 months.

(2)

An outlier can be defined as any value that is:

- greater than the upper quartile + (1.5 × interquartile range)
- less than the lower quartile – (1.5 × interquartile range).

(b) (i) Using the graph paper below draw a box plot to show the information from the staff:student ratio column in the table. You must show any outliers on your box plot, along with calculations used to identify these outliers.



(ii) Comment on the statement " Staff:student ratios are not very different whichever university you look at"

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Mark scheme

Question	Working	Answer	Mark	Notes
7. (a)		Reason	B1	B1 for no correlation or negative correlation
		Explanation	B1	B1 for 'shown by scattered points' or 'shown by line of best fit with negative gradient'
(b)(i)	Median: $\frac{(17.3+17.5)}{2} = 17.4$	Me = 17.4	M1	M1 for method to find median, e.g. put data in order and attempt to find middle value **or** median = 17.4
	Lower Quartile $=15.5 \times \frac{n}{4}$	LQ = 15.5		
	Upper Quartile $= 18 \times \frac{3n}{4}$	UQ = 18	M1	for method to find either LQ or UQ **or** LQ = 15.5 **or** UQ = 18
	1.5 × (18 – 15.5) (= 3.75)		M1	for 1.5 × ('18' – '15.5') (= 3.75)
	Min = 11.75 Max = 21.75 18 + 3.75 = 21.75 so 22.1 outlier 15.5 – 75 = 11.75 so 11.3 and 10.7 outliers	Outliers at 10.7 11.3 22.1	A1	for identification of 11.3 and 22.1 as outliers with calculations present and correct
	Box plot		B1	for a fully-correct box plot showing outliers
(ii)	LQ =15.5, Me =17.4 UQ =18 Min =11.75 Max =21.75	The statement is incorrect	B1	the statement is incorrect with full supporting statement, e.g. two of the universities have substantially lower student/staff ratios and one university has substantially higher student/staff ratio
	Outliers at 10.7 11.3 22.1	Full supporting statement	B1	the statement is incorrect with a supporting statement, e.g. 3 of the universities are substantially different from the rest

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Responses for part (a)

Student response 1

(a) Explain what the scatter graph shows about any relationship between the student:staff ratio and the percentage of students in a career after 6 months.

(2)

There is no correlation. however there seem to be 2 outliers that are not near the others.

Examiner comments

The description of 'no correlation' gets one mark but no explanation has been given in the context of the problem.

1 mark awarded (1/2)

Student response 2

(a) Explain what the scatter graph shows about any relationship between the student:staff ratio and the percentage of students in a career after 6 months.

(2)

There is no relationship between student:staff ratio & % of students in a career after 6 months.

Examiner comments

The fact that there is no relationship gets one mark but the candidate has failed to explain how the graph shows this.

1 mark awarded (1/2)

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Student response 3

(a) Explain what the scatter graph shows about any relationship between the student:staff ratio and the percentage of students in a career after 6 months.

(2)

there is a slightly negative correlation which means there is next to no relationship between teacher student ratio and a career after 6 months

Examiner comments

The answer here is slightly ambiguous but the candidate has been awarded both marks for 'slight negative correlation' linked to 'next to no relationship between teacher student ratio and career after nine months'.

2 marks awarded (2/2)

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Responses for part (b)

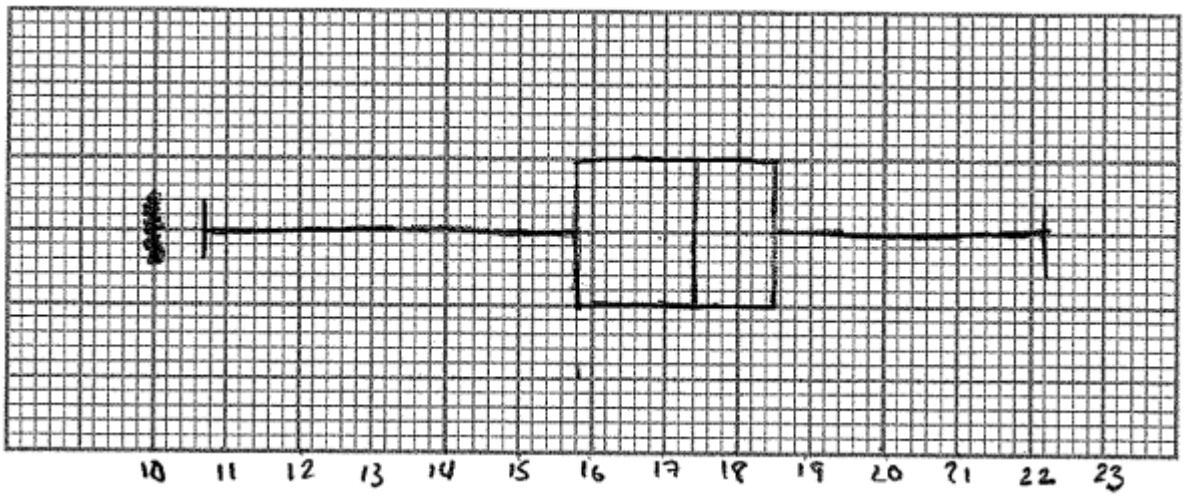
Student response 1

(b) (i) Using the graph paper below draw a box plot to show the information from the staff:student ratio column in the table. You must show any outliers on your box plot, along with calculations used to identify these outliers.

17.4 = median.

UQ = 18.05.

LQ = 15.8.



(ii) Comment on the statement " Staff:student ratios are not very different whichever university you look at"

I disagree as they range from 10.7 : 1 to 22 : 1 which is quite a large distance.

Examiner comments

Credit has been given for finding the median and quartiles but no attempt has been made to identify any outliers. The candidate had made a comment in (ii) but has failed to give correct figures for the ranges.

3 marks awarded (3/7)

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Student response 2

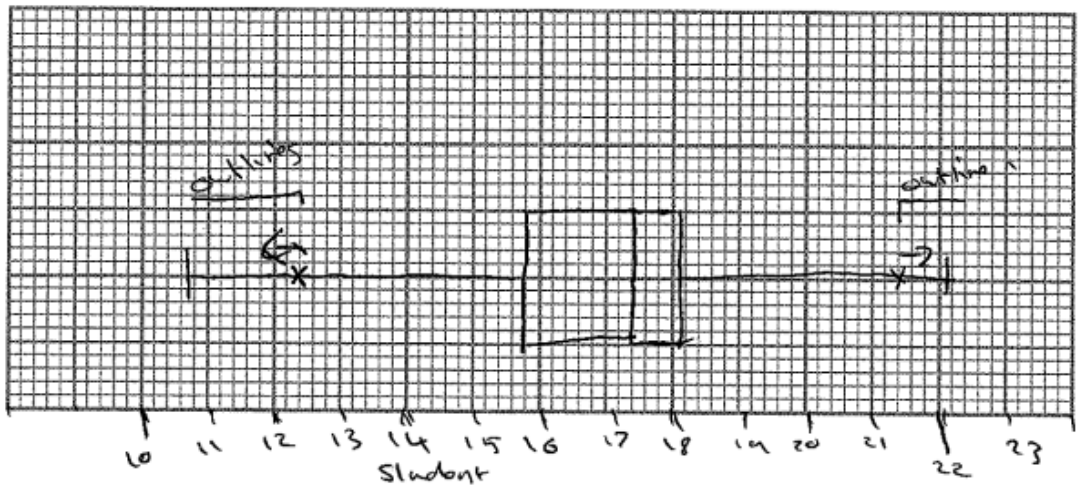
(b) (i) Using the graph paper below draw a box plot to show the information from the staff:student ratio column in the table. You must show any outliers on your box plot, along with calculations used to identify these outliers.

LQ = 15.8 UQ = 18.05

IQR 2.25 × 1.5 = 3.375

LQ − 3.375 = < 12.425

UQ + 3.375 = > 21.425



(ii) Comment on the statement " Staff:student ratios are not very different whichever university you look at"

Examiner comments

The calculations needed to identify outliers have been carried out correctly but the outliers have not been clearly identified. It is best practice to state the outliers before drawing the box plot. Unfortunately, this candidate has confused the conventions used for drawing a box plot and used the whiskers to show outliers and the crosses to show where the whiskers should in fact end. No comments have been provided in (ii).

3 marks awarded (3/7)

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Student response 3

(b) (i) Using the graph paper below draw a box plot to show the information from the staff:student ratio column in the table. You must show any outliers on your box plot, along with calculations used to identify these outliers.

10.7, 11.3, 15.5, 16.1, 16.5, 17.3, 17.5, 17.7, 18, 18.1, 19.8, 22.1

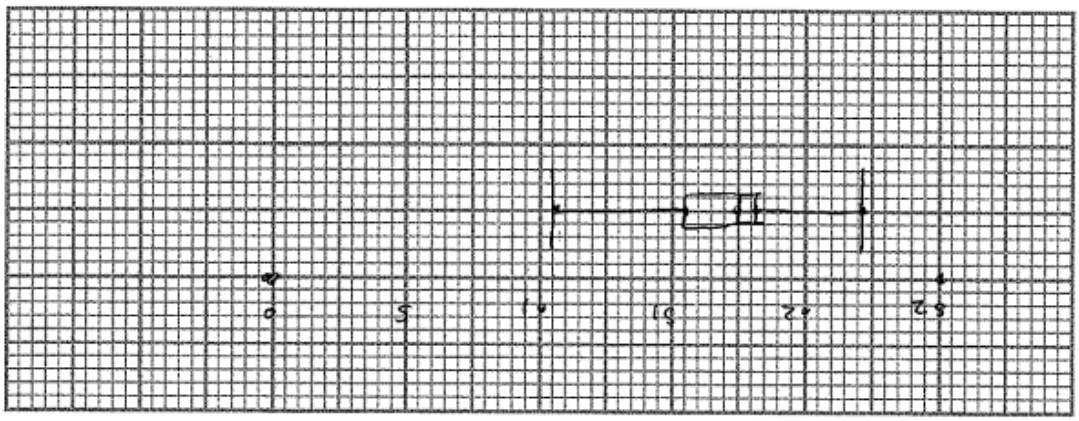
22.1 - 10.7 = 11.4

mid = 17.5

high = 19.1

low = 15.5

iqr = 2.6



(ii) Comment on the statement " Staff:student ratios are not very different whichever university you look at"

they are different since there are more or less teachers in a university but the percentage of students for a career are not very different

(7)

Examiner comments

A clear attempt has been made to find the median and quartiles but no calculations are given in order to identify outliers. A comment had been made in part (ii) but there is no attempt to link in any values or comment as to whether the statement is correct or not.

2 marks awarded (2/7)

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Exemplar question 7

8 Mohammed finished university with a student loan of £14 000.

He started work with a salary of £19 000 per year.

After one year, he had a pay rise of £1500.

At the end of each full year of work:

- 9% of his earnings above £16 365 go towards paying off his loan
- interest of 1.5% of the outstanding amount is added to his loan.

How much will Mohammed still owe on his student loan after 2 full years of work?

(5)

Mark scheme

Question	Working	Answer	Mark	Notes
8.	(19000 – 16365) × 0.09 = 237.15		M1	for (19000 – 16365) × 0.09 (= 237.15)
	(14000 – 237.15) × 1.015		M1	for (14000 – 237.15) × 1.01 (= 13969.29…)
	(19000 + 1500 – 16365) × 0.09 = 372.15		M1	for (19000 + 1500 – 16365) × 0.09 or 237.15 + 0.09 × 1500 (= 372.15)
	(13969.29... – 372.15) × 1.015		M1	M1 for ('13969.29' – 372.15) × 1.015 (= 13801.09989)
	= £13801.09989	(£)13801.10	A1	A1 for answer in range 13801 – 13802

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Responses

Student response 1

8 Mohammed finished university with a student loan of £14 000.

He started work with a salary of £19 000 per year.

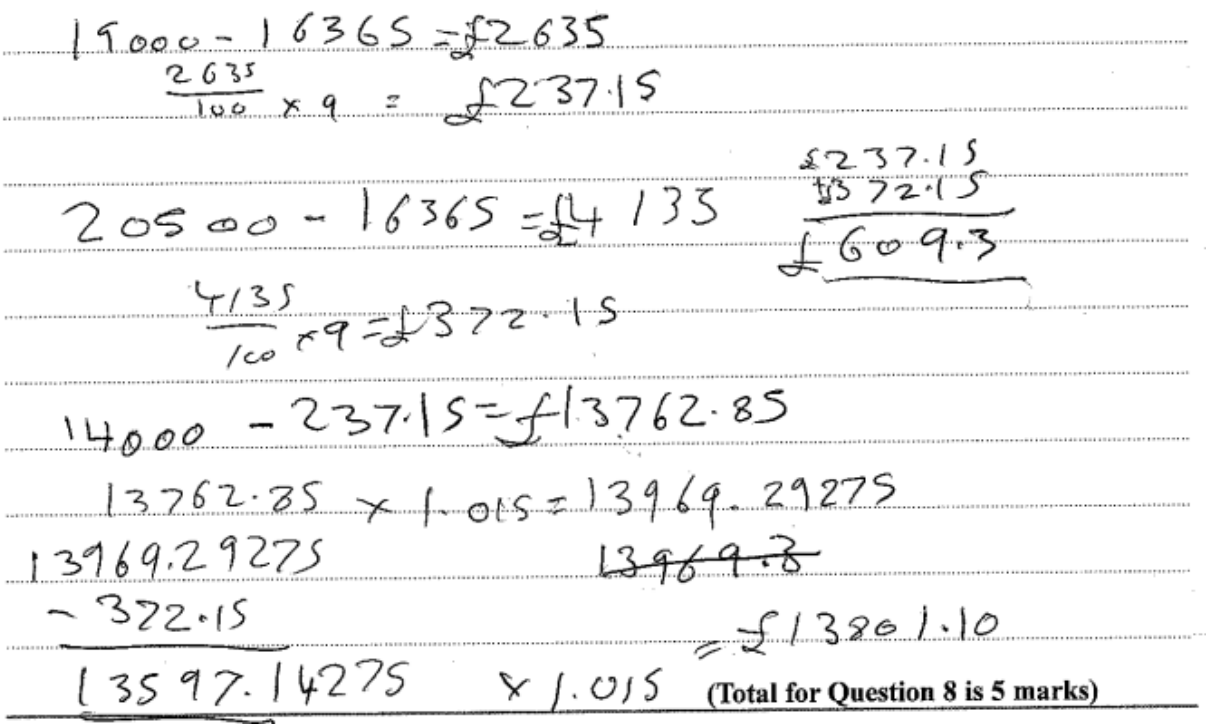
After one year, he had a pay rise of £1500.

At the end of each full year of work:

- 9% of his earnings above £16 365 go towards paying off his loan
- interest of 1.5% of the outstanding amount is added to his loan.

How much will Mohammed still owe on his student loan after 2 full years of work?

(5)



(Total for Question 8 is 5 marks)

Examiner comments

A fully correct solution with all working shown.

5 marks awarded (5/5)

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Student response 2

8 Mohammed finished university with a student loan of £14 000.

He started work with a salary of £19 000 per year.

After one year, he had a pay rise of £1500.

At the end of each full year of work:

- 9% of his earnings above £16 365 go towards paying off his loan
- interest of 1.5% of the outstanding amount is added to his loan.

How much will Mohammed still owe on his student loan after 2 full years of work?

(5)

19000 − 16365 = 2635
9% of 2635 = 237.15
14 000 − 237.5 = £13 762.85
1.5% of 13762.85 = 206.44
13762.85 + 206.44 = £13969.29
£2635 + 1500 = 4135
9% of 4135 = 372.15
13969.29 − 372.15 = £13597.14
1.5% of 13597.15 = 9064.76
13597.15 + 9064.76 = £22661.91

(Total for Question 8 is 5 marks)

Examiner comments

A very nearly completely correct solution. The working is presented in such a way that it is easy to see the candidate's thought processes. Unfortunately, there is an error towards the end but, as the method is all seen, only the final accuracy mark is lost.

4 marks awarded (4/5)

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Student response 3

8 Mohammed finished university with a student loan of £14 000.

He started work with a salary of £19 000 per year.

After one year, he had a pay rise of £1500.

At the end of each full year of work:

- 9% of his earnings above £16 365 go towards paying off his loan
- interest of 1.5% of the outstanding amount is added to his loan.

How much will Mohammed still owe on his student loan after 2 full years of work?

(5)

20,500 - 16,365 = £4,135 × 0·09 = 372·15 × 2 =
= 750·30
14,280 - 750·30 = 13,529·70 X

2635 = 237·15 = 1st year
372·15 = second year
609·30 £13,591·56

14,280 - 609·30 = £13,670·70

(Total for Question 8 is 5 marks)

Examiner comments

The candidate clearly carries out a number of calculations but these are not all shown: after the first two lines of full working only subsequent answers are given. As the later answers are incorrect there is not enough evidence to be able to award any more than two method marks. Candidates should be encouraged to write down all calculations.

2 marks awarded (2/5)

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Task 3: Cost and profit

Exemplar question 8

10 A company sells bird tables and bird feeders.

Shop	Number of bird tables	Number of bird feeders	Total order	Total cost (£)
A	50	25	75	15000
B	100	50	150	30000
C	72	18	90	1980
D	80	60	140	2600
E	160	120	280	5200
F	90	50	140	

The price paid by each shop for a bird table was the same.
The price paid by each shop for a bird feeder was the same.
The total cost for shop F is missing.

(i) Complete the table.

(ii) If the price of a bird table had been £1 more and of a bird feeder £1 less how would this have affected the total cost for shop F?

(6)

Mark scheme

Question	Working	Answer	Mark	Notes
10. (a)(i)		2750	M1	selects two independent rows and writes in a suitable form, e.g. $80x + 60y = 2600$ and $72x + 18y = 1980$
			M1	for correct method to eliminate one variable
			M1	for correct method to enable missing value in table to be found, e.g. using found value for x and substituting to find value of y
			A1	for $x = 25$ and $y = 10$ or $10x = 250$ and $10y = 100$ (or equivalent)
(ii)			A1	for 2750
		Cost increases by (£)40	B1	a correct statement about the change in cost and a correct numerical value

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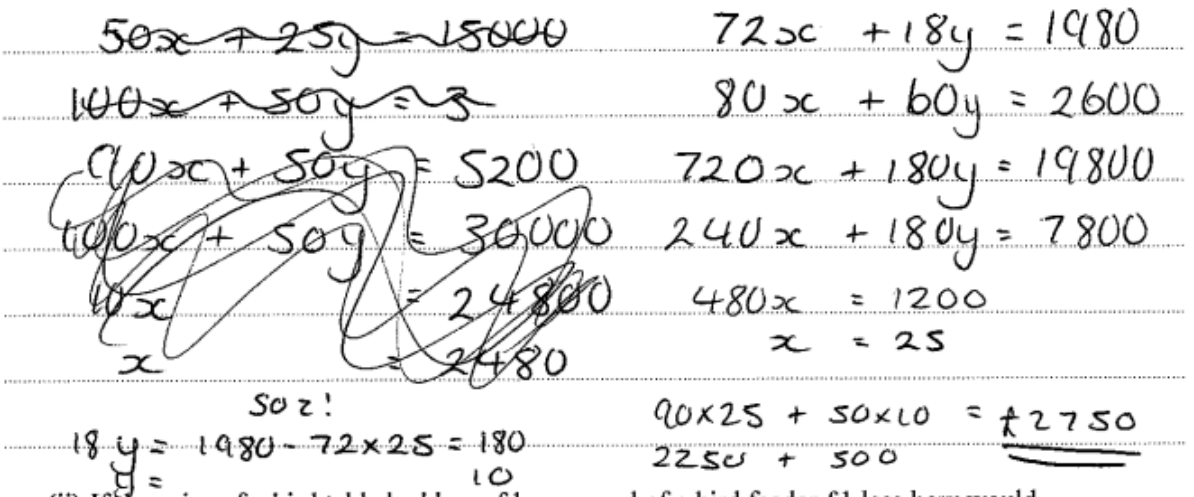
Responses

Student response 1

(i) Complete the table.



(ii) If the price of a bird table had been £1 more and of a bird feeder £1 less how would this have affected the total cost for shop F?

90 - 50 = 40 would be an increase of £40

Examiner comments

The missing value from the table has been correctly calculated with all working shown.

6 marks awarded (6/6)

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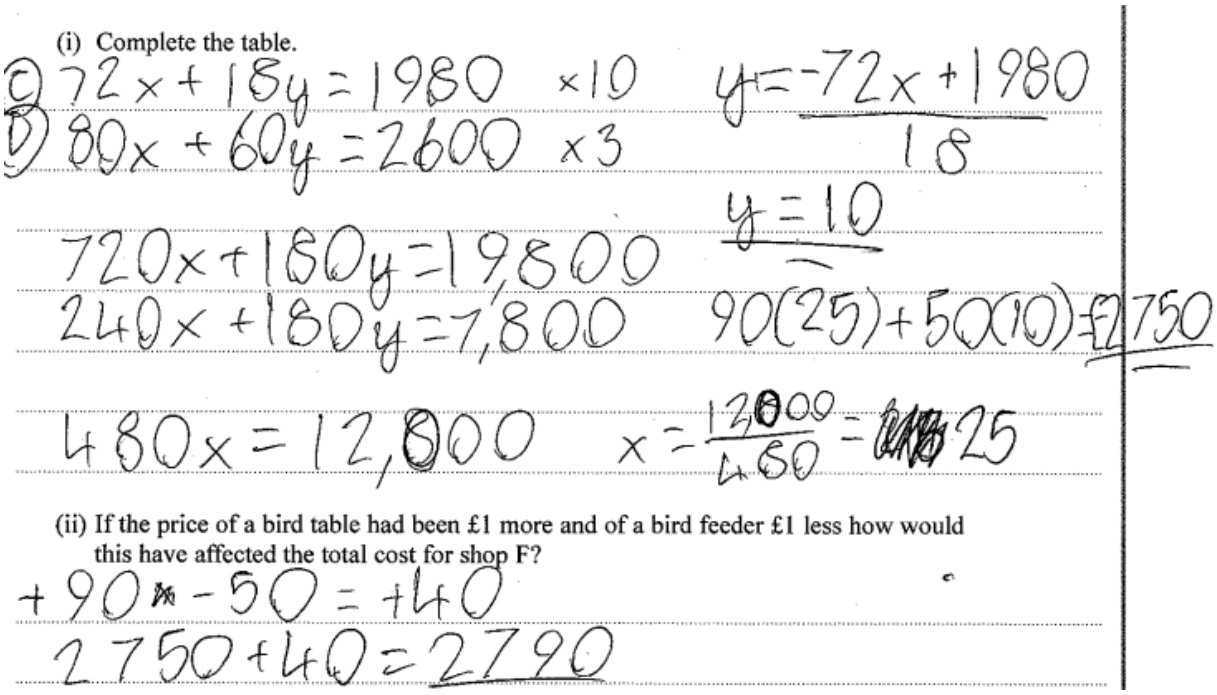
Student response 2



(i) Complete the table.

C) $72x + 18y = 1980$ $\times 10$ $y = \frac{-72x + 1980}{18}$

D) $80x + 60y = 2600$ $\times 3$ $y = 10$

$720x + 180y = 19,800$

$240x + 180y = 7,800$ $90(25) + 50(10) = £2750$

$480x = 12,800$ $x = \frac{12,800}{480} = 25$

(ii) If the price of a bird table had been £1 more and of a bird feeder £1 less how would this have affected the total cost for shop F?

$+90 - 50 = +40$

$2750 + 40 = 2790$

Examiner comments

Part (i) has been correctly answered but then the candidate hasn't quite answered the question in part (ii), opting instead to give the new price rather than state that it would be an increase of £40.

5 marks awarded (5/6)

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Student response 3

bird tables = x
bird feeders = y

(i) Complete the table.

A - 200 B - 200

$72x + 18y = 1980 \div 6$

$80x + 60y = 2600 \div 10$

$12x + 6y = 330$

$8x + 6y = 260$

$3x = 70$

$x = 23.70/3$ sub in

$8(70/3)$

$6y = \frac{220}{3} \times 3 = 18y = 220$

$y = 12.2$

$\frac{560}{3} + 6y = 260$

(ii) If the price of a bird table had been £1 more and of a bird feeder £1 less how would this have affected the total cost for shop F?

Examiner comments

The candidate has made a correct start by forming a pair of simultaneous equations. The method to eliminate one of the variables is correct but an arithmetic error is then made in the subtraction. The value of the found variable is substituted back correctly.

2 marks awarded (2/6)

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Exemplar question 9

11 The company also makes swing seats and benches.

The manager of the company wants to maximise the profit they get from selling swing seats and benches.

Let x be the number of swing seats made each week.

Let y be the number of benches made each week.

(a) The graph on page 27 shows two constraints and the unwanted region.

(i) Write down the constraints shown on the graph, giving your answers as inequalities in terms of x and/or y.

(ii) Give an interpretation of each of your inequalities.

(4)

It takes 10 production hours to make one swing seat.

It takes 4 production hours to make one bench.

There are 160 production hours available in one week.

(b) Write down an inequality to represent this information.

Give your inequality in its simplest form.

(2)

It takes 30 minutes to get each swing seat ready for delivery.

It takes 20 minutes to get each bench ready for delivery.

There are 10 hours available in one week to get ready for delivery.

(c) Using the information above and the inequality formed in (b), add two lines and shading to the graph on page 27 to show the feasible region.

Label the feasible region **R**.

(5)

The company makes a profit of £65 on each swing seat and £40 on each bench.

(d) Find the maximum profit the company could make in one week.

You should state the number of swing seats and benches they should make to achieve this.

You must make your method of solution clear.

(3)

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Mark scheme

Question	Working	Answer	Mark	Notes
11. (a)(i)	$x > 4$ or $x \geq 4$	$x > 4$ or $x \geq 4$	B1	for $x > 4$ or $x \geq 4$
	$2y > x$ or $2y \geq x$	$2y > x$ or $2y \geq x$	B1	for $2y > x$ or $2y \geq x$ or $y > \frac{x}{2}$ or $y \geq \frac{x}{2}$
(ii)	The number of swing seats must be greater than or equal to 4		B1	for, e.g. the number of swing sets must be greater than or equal to 4
	There must be at least twice as many swing seats as benches	Correct interpretation	B1	for, e.g. there must be at least twice as many swing seats as benches (or equivalent)
(b)	$10x + 4y \leq 160$		M1	M1 for $10x + 4y \leq 160$ (condone < at this stage)
	$5x + 2y \leq 80$	$5x + 2y \leq 80$	A1	A1 for $5x + 2y \leq 80$
(c)	$30x + 20y \leq 600$		B1	for $30x + 20y \leq 600$ (or equivalent, e.g. $3x + 2y \leq 60$)
	$5x + 2y = 80$ drawn correctly		B1	for "$5x + 2y = 80$" drawn correctly
	$3x + 2y = 60$ drawn correctly		B1	for "$3x + 2y = 60$" drawn correctly
			B1	for correct shading for at least one inequality added to graph
	Correct region shown on graph unambiguously	Correct region shown	B1	for correct region shown on graph unambiguously
(d)	P = $65x + 40y$ stated/implied	P = $65x + 40y$	M1	for P = $65x + 40y$ or evidence that this has been used to determine profit
	Using profit line **or** for identifying vertices as points to test		M1	for using profit line or for identifying vertices as points to test
	£1250, $x = 10$, $y = 15$	£1250, $x = 10$, $y = 15$	A1	for £1250, $x = 10$, $y = 15$

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Responses for part (a)

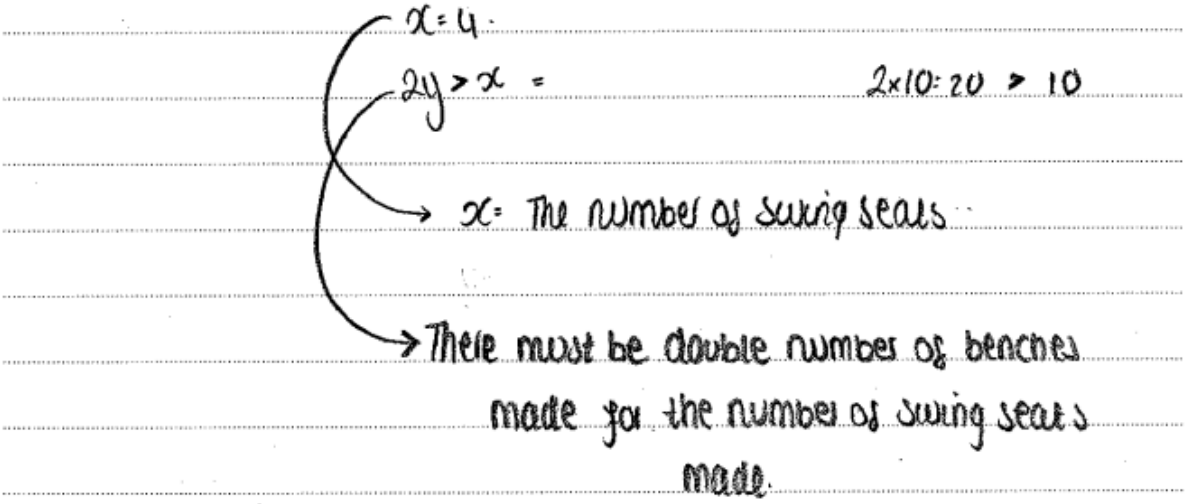
Student response 1

(a) The graph on page 27 shows two constraints and the unwanted region.

(i) Write down the constraints shown on the graph, giving your answers as inequalities in terms of x and/or y.

(ii) Give an interpretation of each of your inequalities.

(4)



Examiner comments

The only mark that can be awarded is for the inequality of $2y > x$; in the interpretation for the inequality it should be $\frac{1}{2}$ rather than double.

1 mark awarded (1/4)

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Student response 2

(a) The graph on page 27 shows two constraints and the unwanted region.

(i) Write down the constraints shown on the graph, giving your answers as inequalities in terms of x and/or y.

(ii) Give an interpretation of each of your inequalities.

(4)

x = swing seats.
y = benches

$y \geqslant \frac{1}{2}x$

$x \geqslant 4$

The number of benches is more than or equal to half the number of swing seats.

The number of swing seats is more than or equal to 4.

Examiner comments

Both inequalities and interpretations are correct.

4 marks awarded (4/4)

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Responses for part (b)

Student response 1

(b) Write down an inequality to represent this information.

Give your inequality in its simplest form.

(2)

$10x + 4y \leqslant 160$

x	y
0	40
16	0

Examiner comments

The inequality given is correct but is unsimplified so only gains one of the two available marks.

1 mark awarded (1/2)

Student response 2

(b) Write down an inequality to represent this information.

Give your inequality in its simplest form.

(2)

$10x + 4y \leqslant 160$

$y \leqslant -\frac{4}{10}x + 40$

Examiner comments

The inequality given is correct but has not been correctly simplified.

1 mark awarded (1/2)

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Responses for part (c)

Student response 1

(c) Using the information above and the inequality formed in (b), add two lines and shading to the graph on page 27 to show the feasible region.

Label the feasible region **R**.

$10 \times 60 = 600$ minutes

(5)

$30x + 20y \leqslant 600$

x	y
0	30
20	0

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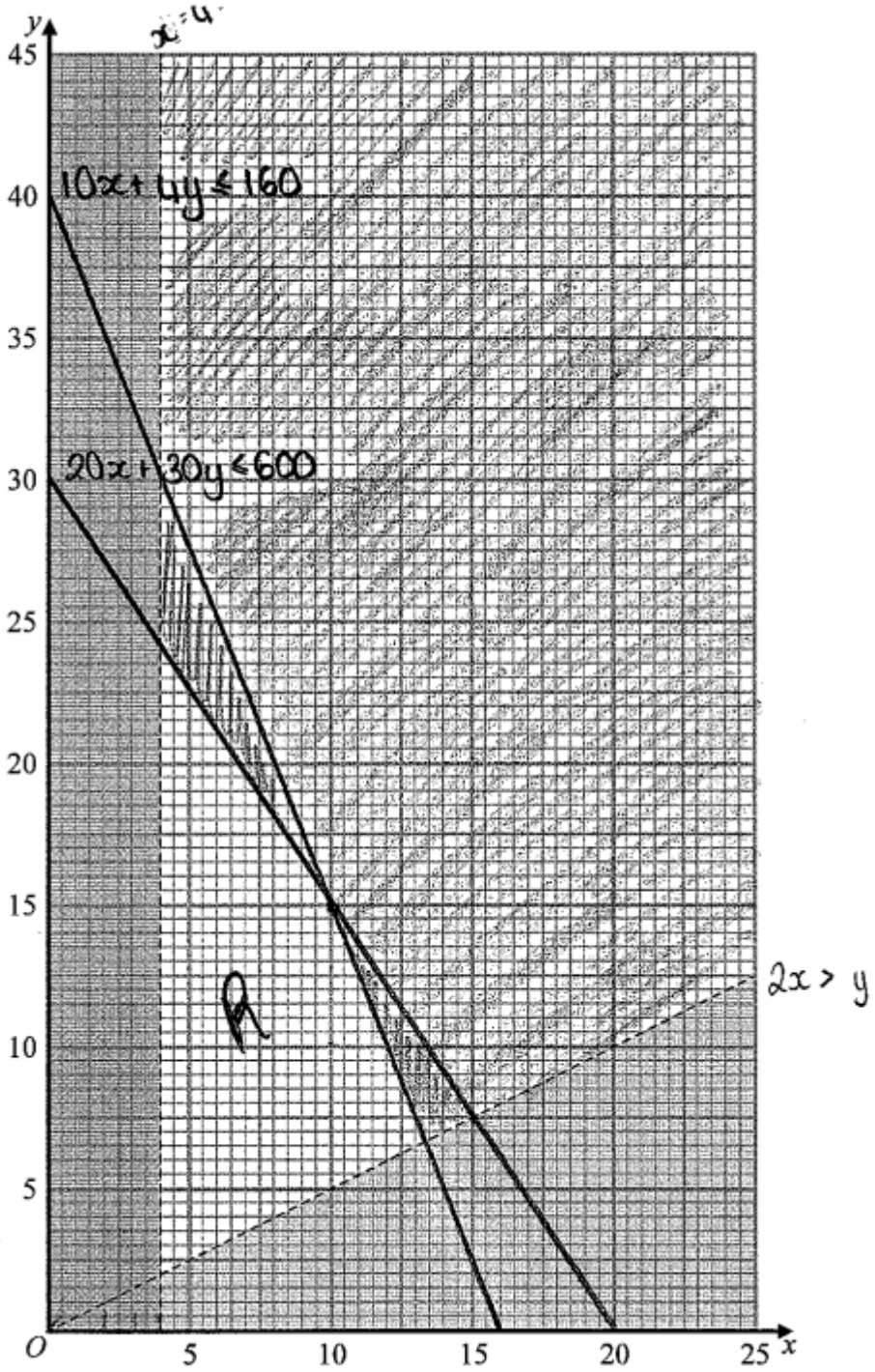

Examiner comments

The correct region has been identified. There is an error in labelling the line $30x + 20y = 600$ as the coefficients of x and y have been transposed. However, as the correct inequality is given in the working space, this has been taken as a transcription error and full marks awarded.

5 marks awarded (5/5)

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Student response 2

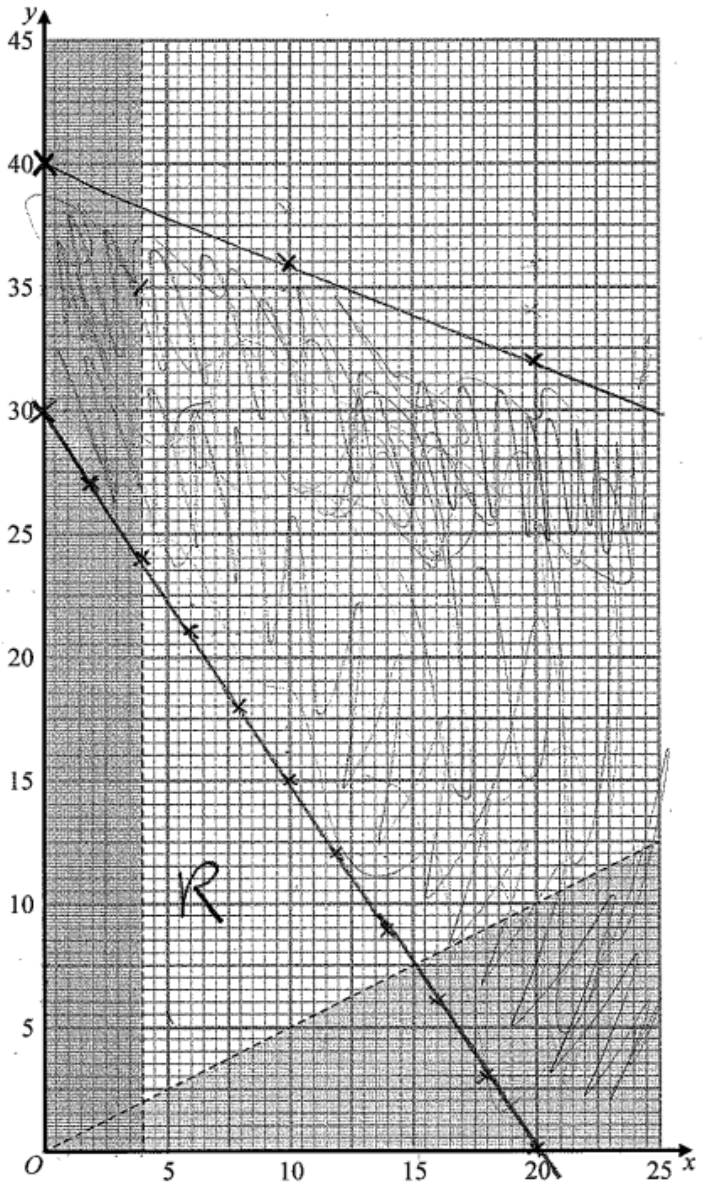
(c) Using the information above and the inequality formed in (b), add two lines and shading to the graph on page 27 to show the feasible region.

Label the feasible region **R**.

(5)

$30x + 20y \leq 600$

$y \leq -\frac{3}{2}x + 30$



Examiner comments

Not all the lines drawn to represent the inequalities are correct.

3 marks awarded (3/5)

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Responses for part (d)

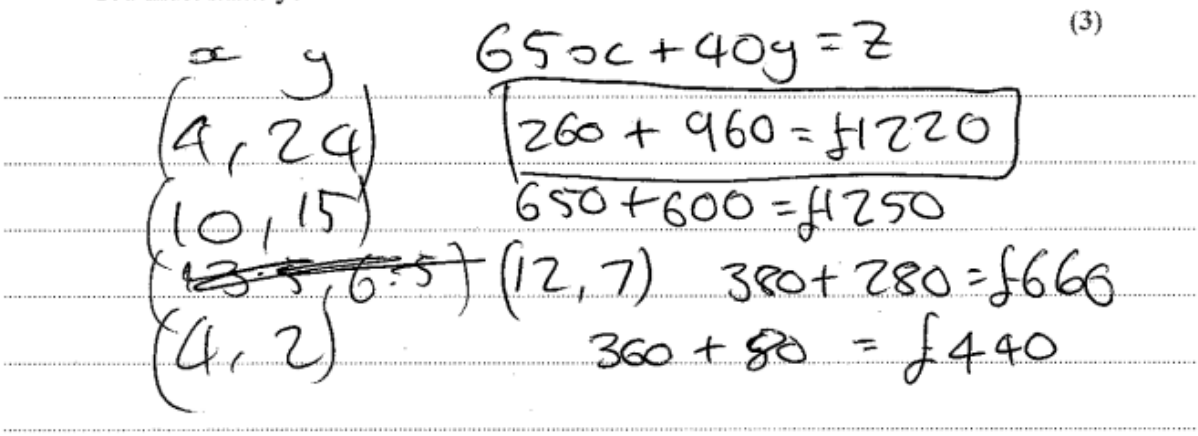
Student response 1

(d) Find the maximum profit the company could make in one week.

You should state the number of swing seats and benches they should make to achieve this.

You must make your method of solution clear.

(3)



Examiner comments

Working is shown and the correct solution is present but the candidate has selected (by circling) the incorrect solution, so only the method marks can be awarded.

2 marks awarded (2/3)

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Student response 2

(d) Find the maximum profit the company could make in one week.

You should state the number of swing seats and benches they should make to achieve this.

You must make your method of solution clear.

(3)

$65x + 40y = 2$

$(\underset{x}{4}, \underset{y}{25})$

$260 + 1000 = 1260$

$(15, 7.5)$

$975 + 300 = 1275$

15 swing seats

7.5 so 8 benches.

Examiner comments

The candidate is clearly showing their method of solution by showing the coordinates of the vertices of their feasible region. Method marks can therefore be awarded but the final accuracy mark will depend on the correct feasible region being found in part (c).

2 marks awarded (2/3)

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Appendix A: Extracts from Paper 1 source booklet

SECTION A: HOUSE PRICES

Data source A

In 2012, 43% of people aged 25–36 owned their own home. Of the first-time buyers (FTB) who bought in 2012, 64% received financial help from their parents.

But it is unlikely future generations will be able to help their offspring in the same way, warns HSBC, the bank which undertook this research.

Its findings, published today, show how much harder it is for 25–36-year-olds to afford a property now than it was for their parents, thanks to bigger deposits, higher house prices and stricter mortgage-lending criteria than previous generations.

	1983	2007	2014
Age of FTB	27	29	29
Property value	£17 021	£129 499	£147 000
LTV ratio	94%	90%	80%
Deposit	£1021	£12 950	£29 400
Borrower income	£8316	£35 000	£35 918

FTB – first-time buyer

LTV – loan-to-value ratio expresses the amount of a mortgage loan as a percentage of the total appraised value of property. For example, if a borrower wants £130 000 to purchase a house worth £250 000, the LTV ratio is £130 000/£250 000 or 52%.

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Data source B

The average house price is rising at 7.3% annually but remains 12% below the 2007 peak.

House prices grew to an average of £175 546 by 31 January 2014, up 7.3% compared to the same period a year ago, according to the Halifax bank.

The UK's biggest mortgage lender said house prices climbed 1.1% in January following a 0.5% fall in December caused by seasonal factors.

The figures will further fuel concerns that a house price bubble is emerging. However, prices are still 12% below the peak of £199 612 in August 2007.

Nicholas Ayre, managing director of homebuying agency Home Fusion, said: 'The definition of a house price bubble is when people will pay anything for a property. This is not what we are seeing here. Many people are still heavily indebted, particularly if they have maxed out on credit cards. This is hardly a market running away with itself.'

But earlier this week economic forecasters the EY Item Club said London is beginning to show 'bubble-like conditions'.

It said the cost of buying in London is 3.5 times more than the average house price in Northern Ireland and over 3.3 times the average in the north east of England. It added that income multiples are now back to pre-crisis levels in London as homeowners take on increasingly expensive mortgages.

The EY Item Club predicted the average house price in London will rise to £600 000 by 2018.

Howard Archer, chief UK economist at IHS Global Insight, said while he does not believe the UK is in the grip of a bubble, house prices look set for strong increases over the coming months – especially as a shortage of available properties is putting pressure on prices in a growing number of locations.

Matthew Pointon, property economist at Capital Economics, said: 'If prices continue to rise by 1.1% per month, house prices on this measure will pass their previous peak by the end of the year, which will stoke concerns that a new house price bubble is forming. But we expect gains will moderate over the year.'

'Rising wholesale interest rates suggest mortgage rates are likely to edge up over the year, curbing demand. And improved selling conditions should mean more homes come onto the market, relieving the upwards pressure on prices.'

Halifax said that more than one million houses were sold in 2013. This is the first time this has happened since 2007, just before the financial crisis struck.

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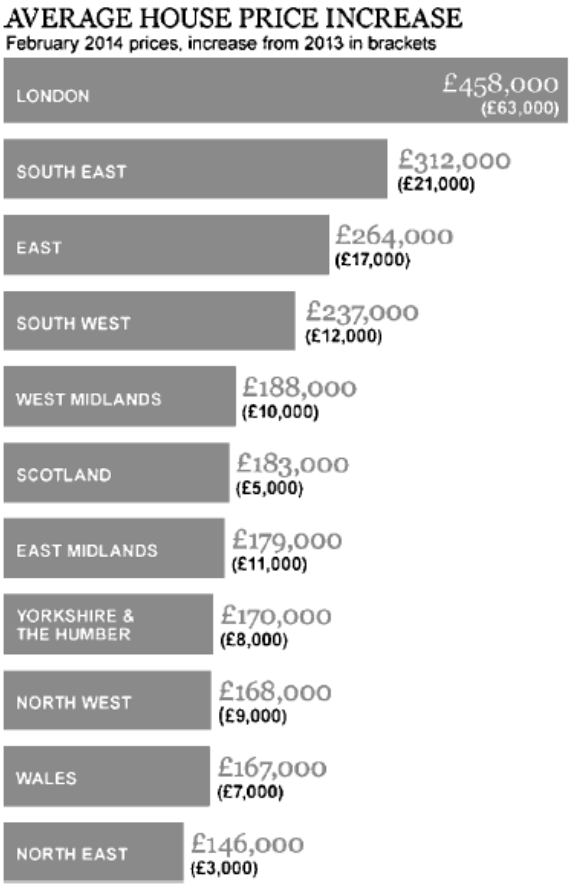
Data source C

London homes increased in value by more than twice the average person's income last year, figures show.

The typical value of properties in the capital rose by £63 000 in the last year, reaching an average of £458 000.

The surge came amid record rises in home prices across the country, according to figures published on Tuesday by the Office for National Statistics (ONS), prompting warnings of 'runaway train' increases. Experts said the rise in London prices was particularly 'extraordinary' when separate figures issued on the same day showed that inflation had fallen to a four-year low.



A graph showing average house price increases (source: ONS)

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Appendix B: Extracts from Paper 2 source booklet

SECTION A: EUROVISION

The Eurovision Song Contest takes place annually. Each country that is part of the European Broadcasting Union is invited to participate and the final line up comprises 10 qualifying countries from the semi-finals and 16 automatic entries to the final. Each country involved in the contest votes for each of the songs featured in the final, with the exception that countries cannot vote for their own entry (so, for example, the televote in the UK will not allow votes in favour of the UK entry).

Data source A

Jury member selection criteria

All jury members are music professionals. They are being asked to judge:

- vocal capacity
- the performance on stage
- the composition and originality of the song
- the overall impression made by the act.

The average age of the jury members is 40 years old, 79 members are female, 106 are male.

Jury members signed a declaration stating that they will vote independently.

The voting rules

Viewers in the countries of the Participating Broadcasters are invited to vote for their favourite songs (without the possibility of voting for the song representing their own country) by means of televoting. In addition, in each participating country there is a National Jury.

With respect to the televoting, the song which has received the highest number of votes shall be ranked first, the song which has received the second highest number of votes shall be ranked second and so on until the last song.

With respect to the National Jury voting, the jury members shall rank first their favourite song, second their second favourite song, third their third favourite song and so on until their least favourite song, which shall be ranked last.

The rankings of the televoting and the jury will then, in each of the participating countries, be used to calculate the average rank of each song. This combined ranking will then be transformed to the 'Eurovision system', with the top-ranked song getting 12 points, the second-highest ranked song 10 points, and the remaining spots, from 8 points to 1 point, given to the songs ranked 3 to 10.

If there is a tie of two or more songs in the combined ranking between televotes and the jury, the song that obtains a better ranking from the televote will be placed ahead of the other country.

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Data source B: Spread sheet for Eurovision 2014 the results

Country receiving votes	Country voting																																		Total votes received	Position
	Albania	Armenia	Austria	Azerbaijan	Belarus	Belgium	Denmark	Estonia	Macedonia	Finland	France	Georgia	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Latvia	Lithuania	Malta	Moldova	Montenegro	Norway	Poland	Portugal	Romania	Russia	San Marino	Slovenia	Spain	Sweden	Switzerland	The Netherlands	Ukraine	United Kingdom		
Armenia (Arm)			12		10		2	5	8	4	12	12	6	7	7	2		6		10		6	3	10		1	4	7	8	6		4	5		7	10		174	4
Austria (Au)	5			1		12	8	4	3	12	10	10	7	12	10	10	12	12	12	6	10	10	7	2	10		12	8	5		12	12	12	12	12	8	12	290	1
Azerbaijan (Az)					A							7																	C	12						1		33	22
Belarus (Bel)		8		7														1			3		5	1					12							6		43	16
Denmark (Den)		1				6				6	3		8			8					1				1	6	5	4		1	6	3	8	3	1		3	74	9
Finland (Fin)			4			3	4	6					4		6	5			6	3					7	3				3			6	4	2		6	72	11
France (Fra)										1																							1					2	26
Germany (Ger)	4	6										5														8		2			2			7		5		39	18
Greece (Gre)	2	7		4	6							4						2	3			1							D								2	35	20
Hungary (Hun)	8		7	8	5	7	3	7	10	5				6		6	1	7		1			4	12			6	10	6	7		2	7	1	4	3		143	5
Iceland (Ice)			2				5				7		2		5				7						6				1	8		1	4		6		4	58	15
Italy	10								2		1											12		6									2					33	21
Malta	1			5						3							3		1											4					5		10	32	23
Montenegro	6	12							12																						7							37	19
Norway			1		4		6	3		7	2		5	3		1	7			5	8	2				7	3	1			5		3	5	10			88	8
Poland				2	B				5		5		10	1	3	3			8				2	4	2						1		2			7		62	14
Romania			8	6	1	5			4								2	8	5			8	12		4		1					8						72	12
Russia		10		12	12			1	6			8		10				3		2	6	5	8				2									4		89	7
San Marino	3	3		3											4								1															14	24
Slovenia									1															8														9	25
Spain	12	2				2		2			6		1				6	4		4	4				5	2		5			4			8		2	5	74	10
Sweden	7		6			10	12	10		10	4	2		2	8	7	4	10		8	7	7	6	3	8	4	8	12	2	10	8	10		6	8	12	7	218	3
Switzerland		5	3									1	3	4	1		5		2		2	3		5		10	7	6			3				3		1	64	13
The Netherlands		4	10		2	8	10	12	7	8	8		12	8	12	12	10		4	12	12				12	12	10	3	3	2	10	7	10	10			8	238	2
Ukraine			5	10	8	4	1	8		2		6		5	2			5	10	7	5		10	7		5			7			6						113	6
United Kingdom						1	7					3				4	8					4			3					5		5						40	17

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Appendix C: Mark scheme codes

Guidance on the use of codes within the mark scheme:

- **B mark** is a standalone mark for accuracy (not linked to a method mark).
- **A mark** is a mark awarded for accuracy.
- **M mark** is a method mark.
- **C mark** is a mark that involves descriptive comment which may or may not contain a numerical solution to the problem.
- **oe** – or equivalent.
- **cao** – correct answer only.
- **ft** – follow through.
- **sc** – special case.
- **awrt** – answers which round to.

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